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ABSTRACT

To address the growing interest in campus planning, design, and construction projects, this anthology compiles articles previously published in "Facilities Manager." The beginning chapters focus on campus architecture, master planning, and project planning. The mid-section of the book offers information on the critical issues of time management, expectations of the architect, why university construction projects are so costly, and the technological trends that are changing the way future projects are viewed. The volume ends with a collection of articles that address steps to ensure successful outcomes: choosing an optimal project delivery approach, defining the need and role of the project manager, and effectively and successfully commissioning a new facility. The chapters are: (1) "Continuity and Contradiction in Contemporary Campus Architecture" (Werner K. Sensbach); (2) "Planning for Master Planning: Setting Realistic Expectations" (John R. Reeve and Marion B. Smith); (3) "Pre-Design Planning" (Ksenia J. Merck and William F. Merck); (4) "Fire the Architect! The Conflicting Perspectives of Architects and Facilities Managers" (Michael Haggans); (5) "Why Do University Buildings Cost so Much?" (E. Gene Kershner); (6) "Timing is Everything: Meeting the Challenge of Aggressive Project Schedules" (Donald Guckert); (7) "Designing Intelligent Campus Buildings for the Information Age" (Jack Caloz); (8) "The Role and Relevance of Project Managers" (Jeff Griffin); (9) "Partnering and Team Building: Applying New Tools to Project Management" (Boone Hellman); (10) "Choosing the Best Delivery Method for Your Facility Project" (Blake V. Peck); and (11) "Commissioning New Construction: Getting It Right the First Time" (Robin Smith). (EV)

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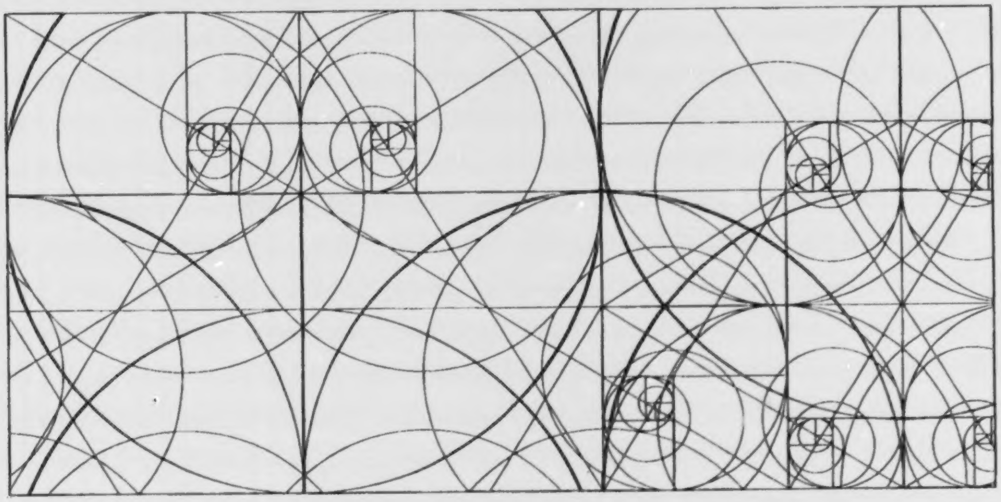

Planning, Design, and Construction of Campus Facilities

Edited by Donald Guckert

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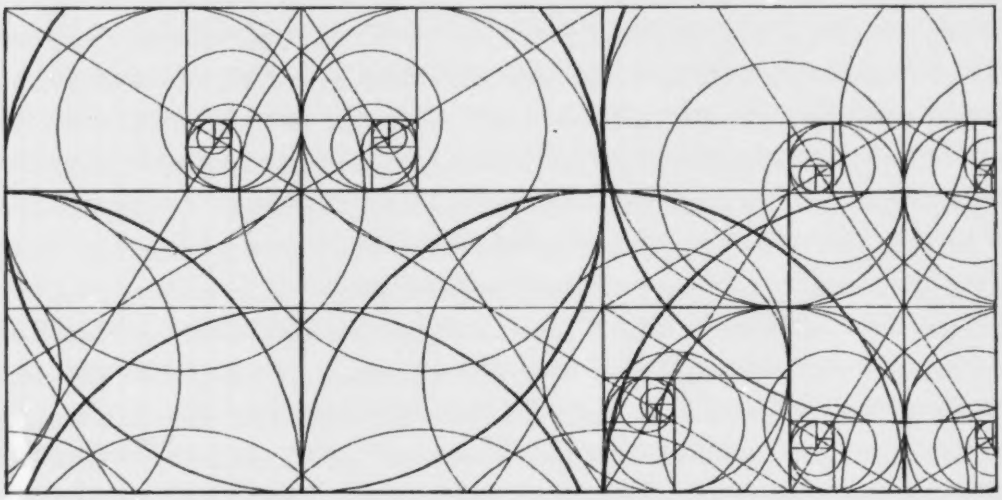

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Edited by Donald Guckert

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*Title changed from original publication

Preface

Planning, design, and construction activities represent the most high-profile work performed by facilities managers on a college campus. Unlike other facilities activities, such as maintenance, grounds, custodial services, and utilities, design and construction activities are usually outside the normal routine of operation. As such, they command more attention and interest from students, faculty, staff, alumni, and the public than any other activity within the facilities management organization.

As facilities managers, we have a three-fold interest in planning, design, and construction projects. First, we must ensure that campus growth follows an orderly plan, that it enhances the campus architecture, and it contributes to the institution's "sense of place." Our campus buildings, open spaces, and landscaping attract prospective students to our institutions and endear returning alumni. Second, we must deliver projects that meet budget, schedule, and quality goals. To do otherwise is to fail in our support of the institutional mission. And third, we must maintain, clean, and provide utilities for newly completed buildings. Without considering and incorporating maintainability and energy efficiency into our projects, our institutions will inevitably face higher operating costs, which forces other projects and priorities to compete for scarce financial resources.

Today, the complexity of facilities dictates collaboration between those responsible for design and construction and those charged with operating, heating, cooling, cleaning, and maintaining the completed facility. However, the direct responsibility for managing these areas of interest often falls under different individuals or departments on a college campus. Still, the planning, design, construction, and operation of campus facilities must be an integrated approach in order to properly serve the greater needs of the institution. This team approach is necessary to achieve a project outcome that balances user needs with stakeholder needs, capital budgets with operating budgets, and quality requirements with time and cost constraints.

The most successful campus projects are the ones that benefit from the scrutiny, review, and contributions of the interdisciplinary and diverse talents found in facilities management organizations. Members of our profession, regardless of the roles they perform for their campuses, are recognizing the opportunity they have to influence the outcome of a planned, designed, and constructed facility. We recognize that today's projects and tomorrow's expansion plans require a team-oriented approach that minimizes callbacks and operational problems and ensures sound stewardship of limited project resources.

The union of diverse, yet intertwined, facilities management interests can clearly be seen at APPA's Institute for Facilities Management. Recognizing that success is dependent on learning, networking, and collaborating, the Institute was restructured in 1998 to emphasize that a broad and comprehensive knowledge of facilities management is necessary to be an effective facilities employee. APPA understood that the critical issues and processes for planning, designing, and constructing a campus facility had become a requisite basic skill for anyone serving in education facilities management. As a result, the Planning, Design & Construction track took its place along side Administration, Operations & Maintenance, and Energy & Utilities as an area of competency essential to the broad-based skill set one needs to effectively manage expanding campus facilities.

Higher education in the United States is in a period of growth unparalleled since the post-World War II expansion. And all areas of the higher education enterprise are fueling this growth. Research institutions are benefiting from aggressive expansion and advancement; housing, dining, and recreation facilities are adapting and upgrading in recognition of their roles in student recruitment and retention; intercollegiate athletics has entered an era in which it views facilities as competitively as the sports they house; learning facilities are transforming to meet expectations for state-of-the-art technology; and plant renewal is receiving greater attention.

The increased emphasis on new, renovated, and repaired facilities corresponds with a heightened demand for classes in planning, design, and construction at the Institute. Before the formal restructuring of the Institute, the Planning, Design, & Construction track enjoyed a steady growth as a special program. As requests for instruction continually outgrew offerings, it became evident that training in this area was attracting a more diverse audience than just architects, engineers, and construction managers. As dean of the Planning, Design & Construction track, I am impressed by the high degree of interest in our classes by people who want to become better project planners and managers, or at least more informed and actively participating stakeholders and service providers.

To further address the growing interest in campus planning, design, and construction projects, APPA has compiled this anthology of articles previously published in *Facilities Manager*. The first chapters focus on campus architecture, master planning, and project planning. The mid-section of the book offers information on the critical issues of time management, expectations of the architect, why university construction projects are so costly, and the technological trends that are changing the way we look at future projects. This volume ends with a collection of articles that address steps we can take to ensure successful outcomes: choosing an optimal project delivery approach, defining the need and role of the project manager, and effectively and successfully commissioning a new facility.

As the editor of this anthology, the most difficult task was selecting the best and most relevant contributions from a wide assortment of choices. The articles in this volume range from the timeless and classic contributions that are as relevant today as they were the day they were written, to recently published articles that address contemporary issues. The authors once again gave their time and effort to contribute to this collection. This anthology is dedicated to them and their spirit of learning, networking, and collaborating.

Acknowledgments

My thanks go to the authors, whose work was selected for this volume, for both their original contributions and recent efforts to revise and update their work. Their articles represent part of a rich collection of articles related to planning, design, and construction, originally chosen and edited by Steve Glazner, APPA's director of communications, for publication in *Facilities Manager.*

This book would not have happened without the assistance of Jennifer Graham, APPA's publications manager. I am very grateful for her energy, effort, and professionalism during the time we spent organizing and editing this book.

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1

Continuity and Contradiction in Contemporary Campus Architecture

by Werner K. Sensbach

It has been said that campus architecture is too important to be left to architects. Whether pointing an accusatory finger at design professionals, or just calling for a more personal and passionate involvement of the university community in the shaping of its environment, this observation also seems to hint at deeper, more pervasive problems of campus architecture. It is no secret that college buildings constructed in the last third of the 20th century have, in many instances, torn the delicate fabric of the traditional campus and, despite the passage of time, have remained unloved intruders in the architectural environment of universities and colleges. Yet what could be the reasons that modern, practical, technically advanced buildings should have caused the loss of the intangible, aesthetic architectural values that once accounted for the exquisite ambiance of the academic environment?

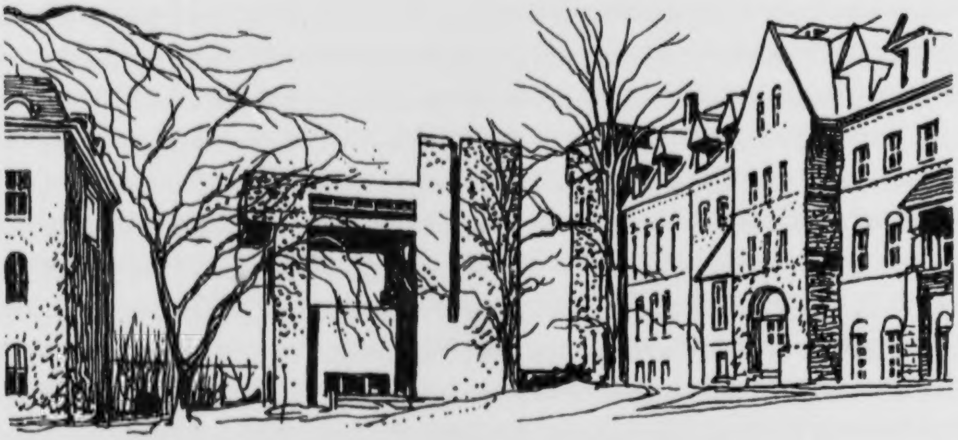
A Guide for the Perplexed

How can college presidents, planning committees, and architectural experts discover that there may be aesthetic problems with their campus grounds if the symptoms are so elusive and difficult to pin down? A tour across the campus grounds may be the first step on the road to discovery and restoration. Traditionally, visitors to a university campus have enjoyed guided tours through the campus grounds conducted by friendly, loquacious student volunteers working for the admissions office. It may happen that after an entertaining walk over old brick pavement, along porticoed halls, animated by tales of the college's founders, faculty follies, student stunts, town-grown tensions, and construction data, the guide will suddenly stop to exclaim, "From here you may observe the more recent university buildings. They are marvels of technology. If you are interested you may proceed on your own." As Gertrude Stein said about Oakland: There is no "there" there.

This not-so-fictional scenario could take place, with local variations, on almost any large campus on the North American continent with a history extending back half a century. Visitors could justifiably wonder what reasons may have caused the buildings constructed since the 1950s to be so alien to the local architectural tradition, appear interchangeable with almost any other modern college building in any part of the country, and be so resistant to integration into the campus fabric. Why should advancements in building technology have diminished the quality of the academic environment?

The chronological appearance of the new buildings on American campuses ties them to the college building boom in the mid 1960s, spawned by the post-war baby boom generation. Even a superficial glance at the campus map or aerial photographs quickly reveals the break between the small-scale buildings of the pre-1950 period and the massive modern structures put up since then. Responding to the urgent need for more classroom space, laboratories, and gymnasia, architects have ignored the lessons of the past and applied modern, Bauhaus style architecture to produce technologically progressive buildings. Large, self-referential, fortress-like, windowless, faceless, and massive structures have muscled their way into the fragile framework of the old campus, offering new building technology but turning their back on architectural context and ignoring social content. Something of value to human life and social interaction seems to have gotten lost in exchange for efficiency and air-conditioned comfort. By abandoning ornament, architects felt the need to turn the whole building into an ornament, giving use to many egregious, frothy, and faddish architectural inventions.

What were the values in academic architecture that universities seem to have given up so lightly? Could a better understanding of the development of the historic campus help us to recapture at least some of the essence of the things we have ignored in the headlong drive for progress?



An uneasy alliance of old and new structures on the Cornell campus.

The Dialectics of Design

Nearly 2,000 years ago, the Roman architect Vitruvius postulated that architecture should provide firmness, commodity, and delight. It is the definition of "delight" that still troubles us today. Contemporary campus architecture probably has as many admirers as it has detractors. Yet, at times, many who try to give voice to their sentiments may find it difficult to put into words exactly what it is they like or dislike about a particular work of architecture. It could be its design, the placement on the site, the choice of building material, the ornamentation of the building, or the landscaping. Mostly, it's just a feeling, a response, a reaction, a passing sensation of pleasure or discomfort that has left an impression in our memory.

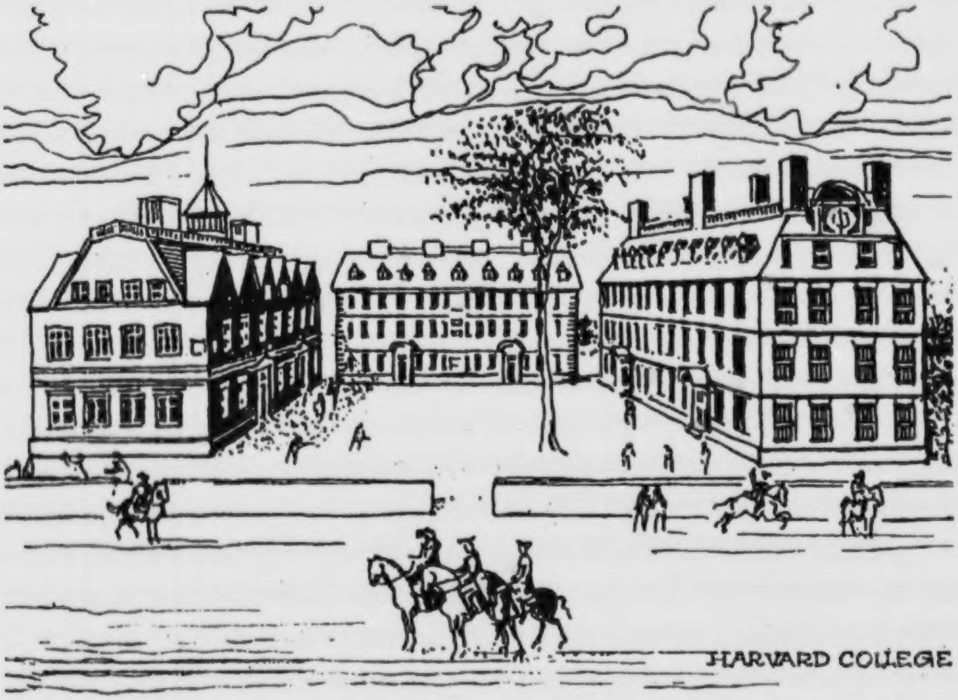
The individuals responsible for guiding the design and development of new buildings on campus frequently face the agonizing experience of having to make split-second decisions on critical aesthetic issues at the moment the architect presents a building design for approval. This decision-making group may include college presidents, deans, members of building committees, governing boards, art review councils, city planning commissions, neighborhood organizations, professors, students, administrators, and accountants. With complete faith in the technical competence of the design team of architects and engineers, the critical audience is often torn between the emotions of acceptance and rejection, elation and confusion, and isolation and fear in the face of major aesthetic issues. Could this be the consequence of being treated to a dialectic of design of such exquisite sophistication that the audience may feel at a loss and give up hope?

Architects, similar to many contemporary artists in music, painting, and sculpture, have developed the mastery of metaphoric manipulation, confronting artistic novices with such arcane terms as: bilateral symmetry, canonical diagonal, paradoxical pastiche, recondite abstraction, parody of the past, ironic reference, deep structure, and message to the future. As Alexander Pope observed, "He gains all points, who pleasingly confounds, surprises, varies and conceals the bounds." Wallowing knee deep in architectural slogans, not many listeners dare to admit that they have understood little of the linguistic pyrotechnics, but only wish to know the cause of the artistic mysteries surrounding the design of a simple college building.

Architectural Expression Reflecting the Educational Mission

From the beginning, the American public has held dear to its heart the campuses of its colleges and universities. Situated in sylvan settings, far away from the toils, temptations, and turmoil of the commercial cities, American campuses traditionally have represented the model of ideal communities. The community of scholars—engaged in the earnest pursuit of abstract or useful knowledge and leading the cloistered life of study, research, and philosophical inquiry—inhabited groups of buildings of modest dimensions but great architectural beauty. Tree-shaded campus walks induced students and professors to carry on learned dialogues and extend knowledge and ideals from the classroom to the world beyond.

With its respect for education as a means of self-improvement, American society has assigned an exemplary role to the American campus. Colleges and universities have been diligent in cultivating and polishing this image ever since and, for the most part, have met with success and the approbation of an admiring public.



Harvard University, with its enclosed yard, represented the prototypical concept of the Colonial American college.

In addition to the large number of rural campuses, American universities for over a century have brought higher education to the doorsteps of city dwellers in densely built-up urban areas. By the turn of the last century, the University of Chicago settled along the midway left by the World's Columbian Exposition in the Highland Park neighborhood on the south side of Chicago. In 1884, Temple University established itself in the midst of a working class neighborhood north of downtown Philadelphia as the prototype of the "street car college." New York City College covered the city with a network of tuition-free colleges, serving as greenhouses for great future intellectual leaders. Charged with a similar mission, the community colleges of the 1960s emerged in response to the need of a changing society, yet as a logical extension of a long-time educational tradition.

Today, the American campus as reflection of a rapidly changing society has expanded far beyond its modest beginning. Whether on a rural or urban campus, American colleges and universities are still society's principal means to open up gateways to knowledge, skills, and a better understanding of the world in which we live. They also hold the key to economic success, respect accorded by society, and the promise of personal fulfillment. It is within this expanded understanding of the educational mission that the architecture of universities and colleges has served in providing the physical framework, the comfort of shelter, and the stage on which the rituals of academic life can be played out. With the financial help of a supportive society and the talents of design professionals, colleges and universities have succeeded in creating campus environments of architectural excellence to the satisfaction of an approving society. Only in recent years have invisible subsurface strains of the industrial society begun to cause visible cracks in the edifice of architectural aesthetics, to the great consternation and confusion of the academic community. A view into the artistic rear view mirror of collegiate architecture may steady our course.

Campus Architecture in its "Proper Style"

American university campuses have traditionally provided the perfect environment in which architectural styles can be displayed, tested, preserved, or discarded. Rarely has the search for an appropriate style been more intensive than now when the architecture of the marketplace and the mechanical world has invaded college campuses. Is there a "collegiate style" of architecture? Thomas Jefferson designed the buildings of the University of Virginia in a neoclassical style reflecting the virtues of democratic Greece and republican Rome as appropriate symbols for the new American nation. Yale, in the latter part of the 19th Century, tore down several of its modest brick dormitories from the Colonial period and, under the influence of John Ruskin's theories, replaced them in the "only proper, the Gothic style." The University of Colorado, in 1922, adopted an Italian hill town style using rose-colored sandstone from the nearby Rocky Mountains and red tile roofs, a decision that, to this day, has assured continuity in the use of material and design.

For Rice University in Texas, architects Cram, Goodhue, and Ferguson, having successfully used a soaring Gothic style and for Princeton University and West Point, they invented a new style from memories of a Mediterranean cruise. R.A. Cram wrote in his autobiography, "I reassembled all the elements from southern France and Italy, Dalmatia, the Peloponnesus, Byzantium, Anatolia, Syria, Sicily, Spain and set myself the task of creating a measurable new style." It is to the architect's credit that he succeeded in combining these far-flung influences into a creditable, visually pleasing college architecture. The Rice campus, in the words of faculty member biologist Julian Huxley, "is an extraordinary spectacle, as of places in a fairy story."

Yet possibly the most inspiring and instructive example of 20th Century college architecture grew under the creative hands of the Finnish architect Eliel Saarinen when he designed and directed Cranbrook Academy in Michigan. Officially established in 1932, Cranbrook revealed the Bauhaus influence on design in America. As it expanded, it emerged as a laboratory of the imaginative use of traditional building material, urban design, landscape, perspective, and the use of sculpture. In the eloquent words of W.V. Eckart: "Saarinen achieved unity by linking buildings in a web of walkways, passages, courts, terraces, and stairs. He invites us to stroll in the compact, intricate, almost medieval townscape. At the end of each vista, a sculpture or other point of interest draws us from one place to the next. Cranbrook's crescendo is the classic grand peristyle...with fountains in front and back, splashing Swedish sculptor Carl Milles' sensuous bronzes."

Cranbrook Academy is built in the best Jeffersonian tradition. Thomas Jefferson thought, "the greatest hazard for new colleges will be their over-building themselves. Large buildings are always ugly, inconvenient, exposed to accident of fire...A small building for the school and lodging for each professor is best...connected by covered ways out of which the rooms of students should open...In fact a University should not be a building but a village." [Thomas Jefferson's letter to L.W. Tazewell, 5 January 1805.]

The problems of contemporary campus architecture therefore appear to be those of scale rather than of style. The values of mechanized society have generated countless singular, inward-directed "signature" buildings. On nearly every campus, large intimidating structures turn their backs on their natural setting or architectural context, ignoring the students' aesthetic and social needs.

Rediscovering Human-Scale Architecture

The seemingly irreversible process advancing toward an increasingly complex, cybernetic civilization was first sensed by the students in the 1960s and 1970s when they denounced technical demagoguery and the disintegration of the scholarly community into academic downtowns and student suburbs..

No institution was more clear-headed and consequential than the University of Oregon when, in the early 1970s, it radically changed its planning approach. In its great experience, and with the assistance of architect Christopher Alexander, it moved from hard-edged drawings to setting up a planning process to implement six planning principles that would achieve order in the campus environment. The pivotal element in the Oregon Experience is the "communal pattern language," developed with community agreement, to guide every building project. "All decisions about what to build and how to build it will be in the hands of the users," the plan stated. And further, "The construction undertaken in each budgetary period will be weighted overwhelmingly toward small projects." Patterns so developed addressed such issues as desirable university growth rate, the relationship of the university and the town, knitting living and learning environments together, and the character of common spaces. "The well-being of the whole will be protected by an annual diagnosis, which explains which spaces are alive, and which ones are dead, at any given moment in the history of the community." With the help of this daring, democratic, difficult, and truly humanistic process, the Oregon Experiment has succeeded in retaining much of the quality of its traditional campus environment.

As we begin a new century and as many universities are coping with the consequences of retrenchment and austerity, the time may be propitious for a reconciliation of rationalism and idealism. To fill the philosophical vacuum left by the loss of traditional values, universities need to redefine the meaning of humanism as they translate recurrent human needs into material form.

The Garden Within

When a university employs a design professional for a building or landscape on its campus, it also enters into an intense personal relationship and engages in a searching dialogue on aesthetic expectations of the participants. Designers, with all their verbal dexterity, are also good listeners, capable of sensing and interpreting the desires and needs of a varied collegiate constituency.

At this stage of the design process, both architect and university representatives will benefit from a mutually supportable architectural philosophy guiding the development of the physical college campus. Such "design guidelines" may be part of a university's long-range master plan, or they may be established in response to the specific conditions of a building or site. Reflecting the variety of American campuses—large or small, rural or urban, traditional or contemporary—design guidelines, if judiciously applied, ease the daunting task of creating order in a complex setting. Its first advantage is the establishment of an architectural vocabulary that carries the same meaning for all participants in the planning process.

Each university will want to discover and declare its own design goals that will serve best its own campus conditions. Reflecting the architectural setting, educational mission, and aesthetic values, design guidelines for campuses may include observations such as the following.

1. Individual campus buildings should be subordinate to the campus spaces in which they participate, be these quadrangles, malls, or streets. Establish a hierarchy of spaces, from large to successively smaller units.

2. Campus spaces should be thought of as outdoor rooms, in which buildings are the walls, walkways and lawns are the floor, and trees are the ceiling.
3. The common ground of the campus quadrangle, surrounded by simple non-competing buildings, should define a space that is both a point of destination as well a place of passage.
4. Accept the limitations of the human eye to recognize objects and activities as the basis to establish human scale. Urban spaces not wider than 80 feet across are perceived as "intimate," at 450 feet they are "civic," and at 4,000 feet they are "monumental." The eye can recognize facial expressions at 40 feet distance, faces at 80 feet, body motions at 450 feet, but cannot see an object when at a distance 35,000 times larger than its size.
5. Large building volumes should be set back from the pedestrian precinct to avoid overwhelming scale, large shadows, and blinding reflections from building facades.
6. Rediscover and make use of the Renaissance knowledge of the relationship of building heights and the width and length of the open space formed by structures. For minimum enclosure at 30 degrees, and with uniform facade height, the length-to-width proportions of the square should be one-to-three, according to a Renaissance rule of thumb.
7. Discourage the design of "signature" buildings. They are a hard act to follow and lead to subsequent architectural high-wire acts.
8. Encourage inventiveness, and efficient building function, but avoid design fads. They resemble impressions left by abandoned buildings on former world's fair exhibition grounds.

9. Make the landscape, the choice of trees, and the sequence of open spaces the essential elements of coherence and continuity. Preserve significant vistas; make the visual sensations of the pedestrian scholar the measurement of design satisfaction.

10. Make a "lawn of grass and trees" (as suggested by Thomas Jefferson) the primary design element sheltering campus spaces. Where appropriate, introduce intermediate landscape groups, but avoid "prettifying" the campus with landscaping schemes more fitting to a private home. They are perishable and expensive to maintain.

11. Design campus spaces that are pleasant to experience and easy to understand. Upon entering a campus space, a pedestrian needs to see and understand the size of the open space, the height of the buildings, the number of floors, the entrances to buildings, and the walkways across the open space.

12. Introduce light and shadow in the design of the exterior of buildings; avoid "dead" walls. Welcome elements of symbolic architecture, such as columns, arched entranceways, ramps, and stairs as an enrichment of the architectural environment of the university.

The list of desiderata could be modified and expanded at will to reflect local conditions of topography, climate, urban proximities, and institutional mission. Once these requirements have become routine review criteria, they will quickly prove their usefulness to designers and university officials in the development of architectural projects for the college campus.

The Sharper Image

In an age of discontinuity, when young people look for life-sustaining values useful for the years ahead, universities are beginning to learn to treat the architecture of the campus as a powerful educational tool, working in concert with the academic program of the institution. If a new generation of students is beginning to express its concern about the quality of the campus, its buildings, landscape, and the ambiance of its environment, it will be well to remember the importance of the college years in the life of an individual and, by extension, of the human community.

For most students, the long years spent in academic pursuits on a university campus mean not only an important period of maturing from adolescence to adulthood, but also years of heightened sensory and creative ability. These are years when the powers of feeling, of reflection, of reasoning and memory, have reached a greater degree of sharpness than ever before. During college years, young minds absorb impressions that last for a lifetime, leaving memories of the myriad forms and substances of life, a stream of blazing pageantry of images, shapes, odors, sounds, colors, and the feel of things. Whether "academical village" or "science city," the educational campus serves superbly as an example for Aristotle's definition of the urban community as a place "where people live a common life for a noble end."

2 Planning for Master Planning: Setting Realistic Expectations

by John R. Reeve and Marion B. Smith

Colleges, schools, and universities can no longer afford simply to react to changes in society; institutions that will thrive and prosper in the 21st Century are those able to anticipate change, redefine themselves, and align their facilities to support their strategic plan. And all this must be accomplished in a logical sequence and within a practical time frame. For that, a good master plan is essential.

But what exactly is master planning, and how does a college initiate a process that will ensure its effectiveness? Master plans come in a variety of forms. They can deal with a broad overview of the campus, focusing on site development or site acquisition issues. Or they can look at specific factors in detail, such as where to plant a tree or how to comply with various regulatory authorities.

Regardless of the particular focus, all master plans have certain fundamental characteristics that shape the dynamics of the process. This article will help you take some of the uncertainty and risk out of the process, providing guidance for how to get a master plan underway to assure its success.

Survey

We conducted a survey of a representative sample of APPA members about planning for master planning. It was used to gather and organize information on what needs to be considered and the activities that need to take place in order to launch an effective master planning process. The responses to that survey (a 50 percent return rate) are included in this chapter.

The survey posed the following questions:

For your institution, what issues should be addressed by a successful master plan?

Bear in mind that while the facilities managers polled perceived the need to identify long-range options as the most important issue, different constituent groups may take a different view on what is important. For instance, if college development directors were asked the same question, they might well emphasize that fundraising strategies are the most important—the factor ranked lowest by the APPA membership. A critical lesson is to accept that these different perspectives exist and factor that knowledge into your approach.

What reasons could motivate your institution to begin a master planning process?

A planning process is driven by changing strategic goals, which, more often than not, derive from changes in the institution's competitive environment. This is especially true in the case of a college that has not previously conducted such a process and is not in the habit of revisiting its strategic assumptions. The development concepts and priorities may linger from past administrators. New leadership must, as a first step, test those assumptions and validate or change the de facto plan. Of course, a broad range of other external factors such as changing demographics and enrollments, competition, and general economic conditions may also have an impact.

Who internally should represent your institution on a planning committee for the master planning process?

Ninety percent of our APPA sample responded that facilities managers need to be involved. The key, however, is that all the campus interest groups (administration, staff, students) must be represented. While students were regarded as less important for participation on the planning team, more than 40 percent of respondents did say that getting student input was important for success.

In your view, what obstacles do you think exist in starting a master planning process?
Economic constraints, limited understanding of the benefits, and limited definition of goals, time, and cost top the list of obstacles. But the root source behind these obstacles is the limited understanding of what master planning is within the administration. This translates into a lack of commitment in terms of time, money, and leadership.

How would a successful master plan for your institution be used?
Primarily, a master plan is perceived as equally useful as a guide for future development and for scheduling capital budget projections. Less clearly understood is its value as a vehicle for management decision making. It is noteworthy that some respondents recognized a master plan as a means to an end: achieving board approval for projects.

What services should a successful master plan for your institution include?
Overwhelmingly, a master plan is perceived as including guidelines for future development. Clarifying the future of academic programs comes second. Overall, the services that were viewed as critical to the process apply to assembling clear information as a baseline for the future, as well as those that define the direction of future actions such as space allocations and land acquisition. With the proper core, the data collection and documentation can set the stage for facilities management.

What information would help you to begin a master planning process at your institution?
Respondents made clear that a definition of the scope of the master planning process is the single most important task to be undertaken.

And that requires a clear understanding of the basic essentials of a master planning process. For budgeting purposes, they need to know what fees to accept. The appropriate fee and personnel time commitments can be clarified at the start, with the schedule conforming to expectations. Early involvement of a master planning consultant can be helpful in defining the tasks, streamlining the process, and anticipating problems.

The Basic Concepts of Master Planning

Well-known management guru Peter Drucker made this comment about planning: "Long-range planning does not deal with future decisions, but with the future of present decisions." Put another way, it is what we do today that shapes tomorrow. But how do you rationally anticipate the future impact of today's decisions?

To start with, you must have a vision of where you want to go. To paraphrase the Cheshire Cat in *Alice in Wonderland*, "When you don't know where you're going, any road will get you there." An effective master planning process, on the other hand, involves making decisions about how you can get to where you want to go.

If a master plan responds only to the existing site and its buildings, it is reacting to the status quo rather than anticipating what the college wants to be and how it must change to get there. Rather, the master plan must anticipate the future by considering facility needs generated by the college's mission statement, strategic plan, and corresponding academic program. The strategic plan is the critical step in establishing the framework for the master plan; if it is not in place already, it should be the first step in the master planning process.

Although it is common to think about the master plan in terms of a distinct product, such a view is misleading. The process of creating a master plan is as important as the product—with a flawed process the resulting product may languish on the shelf.

What Does the Master Plan Need to Accomplish?

The key to a successful planning process is to set realistic expectations and provide adequate resources. The first step is to identify the driving needs for the master plan in order to define the goals of the process—what this effort needs to accomplish.

Reasons for embarking on a campus master plan are usually broad, covering guidelines for future development, changes in the market, and competition for funding. Starting a master plan is usually triggered by the need for specific answers to specific questions, such as, "Where are we going to put the library?" Or, "What potential does this parcel of land have for our future?" Whatever the immediate reason, a sound master planning process can turn that need into an opportunity. This cannot be stressed enough. For example, it may be possible to incorporate the implementation of a new chiller loop into upcoming building projects.

Once these motivations for planning are recognized, specific outcomes for the planning process can be defined, and the process tasks and necessary services will be evident.

What Professional Services are Required?

Needs and issues to be addressed lead to a definition of services (tasks) to satisfy them. Some pieces may already be in place, such as a mission statement. The remaining tasks will constitute the master planning process and may include aspects of the following:

- Strategic review
- Functional analysis

- Physical analysis
- Solution development
- Plan document

The figure below presents master planning activities, with what we view as the critical core activities shown checked off. These checked activities, taken as a whole, make the master planning process more than just a study of various characteristics of a campus. Instead it becomes a comprehensive decision-making system.

MASTER PLANNING SERVICES

STRATEGIC REVIEW

☑ Institution Mission/Role
  - Mission statement
  - Strategic plan
  - Financial plan

☐ Market Enrollment, Analysis
  - Demographic analysis
  - Enrollment analysis/management
  - Market analysis/peer institution study

☑ Academic Program
  - Academic program analysis and validation
  - Goals/direction
  - Program alignment

FUNCTIONAL ANALYSIS

☑ Functional/Utilization Analysis
  - Operations analysis
  - Utilization review

☑ Facility Space Program
  - Space needs assessment
  - Comparative/normative standards
  - Space listing

PHYSICAL ANALYSIS

☑ Campus/Community Analysis
  - Land use and zoning
  - Physical and circulation
  - Campus quality/image

☐ Building/Systems Analysis
  - Inventory of space
  - Functional/zoning
  - Appropriateness of use
  - Systems review and analysis
  - ADA analysis

SOLUTION DEVELOPMENT

☑ Development Potential
  - Opportunities/constraints

☑ Options and Evaluation
  - Options/strategies development
  - Cost estimating
  - Evaluation criteria

☐ Financial Analysis/Feasibility

PLAN DOCUMENT

☑ Site Development
  - Site master plan
  - Site acquisition plan
  - Landscape master plan

☐ Building Development
  - Building master plan
  - Interiors master plan

☐ Design Guidelines
  - Campus planning concepts
  - Architectural vocabulary
  - Landscape treatment

☑ Implementation Strategies
  - Cost estimating
  - Phasing schedule

What End Product Would Be Most Valuable?

In addition to defining services, it is important to understand how you will use the master plan and the form the product should take. This product can vary enormously depending on how you intend to use the plan, from written narratives to models, even videos, with a corresponding range of costs. Wherever possible, information should be presented graphically as well as in text. A picture is worth a thousand words. While text and figures may be precise and comprehensive, graphic images more powerfully communicate the current situations and the outcomes of implementing recommendations. This is a great benefit, as most people have difficulty translating text into its three-dimensional implications.

Perhaps the most useful is a document that summarizes the process, presents data and analysis, and makes recommendations regarding future decisions. Cost and phasing information is fundamental, especially regarding projects that need to be executed before other projects can proceed.

If the master plan is to be used for making decisions internally, for scheduling and financial projections for future capital projects, the documentation can be relatively lean, with simple (and less expensive) covers and graphics. If the master plan is to be used for communicating the "new campus vision" for approval by the board or other regulating authorities, or for fundraising, a more elaborate document that sells and builds wide consensus may be appropriate. The level of detail required relates to the audience, including both the existing base of knowledge and the possible response to and endorsement of the recommendations and other information.

A tailored combination may serve you well with an executive summary as the "selling" document, while the detailed record of the process might be less elaborate in its presentation. In any case, a detailed record of the logic of the master plan is useful since it allows the college to revisit decisions as economic, demographic, political, and personnel changes occur.

Who Should Be Involved?

Once services and tasks are identified, it is possible to identify who should be involved in the process. Faculty members will be most concerned with academic and space programming. All physical development issues will be of great interest to facilities managers. Strategies that will affect campus image or will require funding will be of great concern to administrators. From the president on down, the overall success of the planning process is dependent on incorporating the interests of many different constituencies.

The planning committee itself should not exceed 30 people. It is critical to involve representatives of different decision-making levels, including a member of your governing body, to ensure their support. And don't forget those important constituents: alumni, the students, and perhaps even their parents, who are paying tuition. In some cases, you may wish to involve the community and key local businesses in some manner during the process. This can be especially valuable if a town-grown tension is prevalent. In lieu of including representatives from all these categories on the planning committee, consider setting up task forces around particular issues.

Involving these groups will ensure that all interests are represented and that the plan is balanced and supported by all groups. Also, including some doers as well as thinkers in the process will give the plan a much better chance of being implemented. Planning can be lengthy, and those involved need to commit their time, with meetings scheduled well in advance so that participants can be assured of attending. Missed meetings create an unfortunate dynamic that compromises the balance and continuity of the outcomes of discussion.

What Useful Information is Already Available?

Often a considerable amount of information is already available. Existing records can facilitate inventories of current space allocations and actual space uses. Increasingly, campus sites and buildings are already documented on computer graphic systems, saving both time and money in the master planning process. If a particular building has been the subject of a study in the past, that information can also provide direction for the assessment of other buildings, as well as information about building and site systems.

Available information can reduce the time needed to analyze present facilities, thus reducing the total time of the planning process.

How Much Time Will it Take?

When a master plan process is finally authorized, someone is usually in a hurry. Funds have been raised for a new building and everyone is eager to get going. Or perhaps the plan is mandated by state or local government and it has to be filed by a particular date.

The scope of the plan, the size of the institution, and the number of people involved are all factors affecting the process duration, but it is possible to push the process too fast or let it drag on too long. Either will risk the success of the plan. Remember that your master plan may very well be setting the direction for the next 10 to 15 years. The consequences of these decisions are significant and you ought to invest adequate time to think through the repercussions of various scenarios. On the other hand, too slow a process will make it difficult to keep the participants focused and to sustain creative involvement.

A realistic amount of time for a thorough master planning process can range from six to nine months. Since some information can be developed concurrently, tasks can be overlapped to a degree.

Even with an outside consultant, you will need to commit the time for some of your staff to coordinate the effort. Task forces and planning committee members must make a commitment to attend review meetings throughout the process. Even with other obligations, the campus staff commitment may be substantial, perhaps as much as one-third of their time.

How are Qualified Consultants Selected?

The decision of who to hire to assist you in your master planning process is critical because you will look to this party to lead the process, provide insights from other institutions, and provide a significant measure of creativity. To make an informed decision, the first question you should ask is: What factors are important to you for your situation?

Experience in master planning and knowledge of educational issues are fundamental; you should look for a consultant who is an acknowledged expert at master planning. And while architectural design knowledge for educational facilities is an asset, it is wise to make the distinction between designing a building and campus planning. Also, the total team warrants scrutiny, including associated consultants such as engineers or academic planners. It will be individual people who will do the project, so look beyond firm credentials.

Just as important is the chemistry between your institution's in-house planning team and the consultant's personnel. Spend time getting to know the consultants. You will develop a feel for their communication style and an indication for how you will get along for the duration of the planning process.

But where can you get the information you need to shed light on these factors? Interestingly, the standard sources of information—formal interviews, submittals of qualifications, and scope/fee proposals—don't always shed light on some of the most important factors. Visit the offices of candidate firms, and have them come to your campus and meet with key people in informal workshop settings.

How Much Will it Cost?

The amount of money you need to budget for an outside consultant will depend not only on the services and products that you have defined, but also on the data you are able to provide the consultants in order to get started. If you have good existing documents of your campus, and the buildings, and how they are used, much of the information-gathering time required by the consultants will be reduced. Also, if you have the site and buildings already on a computer graphic system, it will further reduce the time your consultant needs to establish the base drawings for the plan.

A well-spent penny for the master planning process can save dollars when it comes to implementation. This truism can prove itself in several ways:

1. Guided by a master planning process, your resources will be applied to achieve your most important goals—your physical assets will support your strategic goals.
2. You will get it right the first time, winning plaudits and gratitude, especially when facilities are ready for the commencement of classes after a break.
3. You can actually create economies with good planning, such as avoiding some expenses and fulfilling others by avoiding overlapping or repetition.

Keep in mind that you are not buying a commodity or product. You are paying for the time of professionals (and the per hour cost of professional time doesn't vary much), so the key to getting value is to make sure the time is focused on the issues that are most important to your situation.

Costs will vary from institution to institution depending on the scope of services; however, the cost of the master plan should be regarded as an investment instead of an expense. At the very least it will save money and it can be used to leverage funding or donations to the college.

Given budgetary constraints, you may wish to spread the master planning process over several years to reduce the impact to your budget. The mission statement and strategic planning might be scheduled for one year, the academic and space programming for another, and the development strategies for the next year. Subsequent years might include more detailed studies that fit into the plan, such as a campus utility plan or ADA compliance.

Your development office should follow in the wake of the planning effort to key in on fundraising opportunities. Involving local businesses in the process may give you the opportunity to meet some of their needs in combination with your own to generate income in the future. At the very least, you can keep them interested and involved with your institution.

How is Planning Promoted?

Though you may already be sold on the value of master planning, others in your organization may need to be convinced—if the president isn't on board, nothing much will happen. By reviewing some of the benefits with your president, you may be able to trigger interest so that he or she may talk to counterparts who have already gone through the master planning process. Internally, you may need to point out the benefits to sell the concept. The president may respond to the opportunity to bring a visual image to his or her vision for the college. The business officer may appreciate the potential for logical capital budget planning and apply resources in a balanced, cost-effective manner. The development director or president will appreciate having a clear explanation for how donations to the institution will be applied.

In large part, the challenge is to communicate the benefits and build a broad base of support. It is possible for everyone to feel they will get something useful out of the process. Additional reasons for undertaking a master planning process include:

- Ensuring that your facilities support your strategic goals.
- Creating a shared vision within your institution.
- Making better use of your existing site and facility needs.
- Anticipating your future site and facility needs.
- Avoiding waste and disruption resulting from piecemeal projects.
- Establishing a realistic schedule and capital budget.
- Unifying the aesthetic assets of your campus.
- Enhancing credibility with lending institutions.
- Developing campus maps and building plans for facilities management.
- Focusing and energizing your fundraising and development efforts.

Conclusion

Redefining the college, university, or school mission and restructuring the institution is characterized by increasing competition for resources amid the clamor of demands on facilities. In this environment, master planning is increasingly recognized as an indispensable tool for management. In addition, a master plan can be a valuable ally to help facilities managers face problems and issues in an increasingly complex world.

3 Pre-Design Planning

by Ksenia J. Merck and William F. Merck

For the little things in life, we follow common sense rules to avoid problems. The carpenter tells us to "measure twice, cut once." However, for the larger undertakings in life, we seem much more willing to put the outcome in the hands of fate. Perhaps this is because the larger things come into our life infrequently and we have no simple rules or prior experience to guide us. We forge ahead, uncharacteristically optimistic, thinking that as others manage to succeed with big projects, once we get into ours, we will figure things out too. True, but for multimillion dollar building projects, by the time one "figures things out," hundreds of thousands of dollars are wasted, months of staff time misdirected, and serious thought expended on the best way to explain to the boss why this disaster is really not so bad.

There is time between the boss announcing that you will be in charge of a new, large building project, one that will "transform the institution," the "watershed building that will make the future" (no pressure here), and the point where you hire the architectural firm (internationally recognized of course) to prepare the construction design documents.

It is our experience that this period is absolutely crucial for setting a course that will lead to success. The following points will help you develop a building program that will get your design consultants off to a correct start in developing a design solution. The discipline will add years to your career!

From the Original Idea

Once the original idea for a project has been passed to you for implementation, the only two questions your boss will have for you from that time on will be "How much will it cost?" and "When will it be complete?" A natural survival instinct immediately suggests hiring an architect to share the risk with you for this newly acquired assignment. Succumbing to this inclination is not good. In a long footrace, a moderate pace in the beginning allows a runner to pick up speed later, shortening the total time to the finish. Similarly, a slower, more deliberate beginning in a building project will lead almost inevitably to increased speed later in the project, less cost, and a better building.

The following points form the outline for the planning that should precede any architectural design drawings for a building project. This planning will give a solid base for all that comes later.

1. Define precisely the problem to be solved by the proposed building project, in writing.
2. Define the goals that will be achieved by solving the problem, in writing.
3. Identify the people most appropriate for this project and specify their roles.
4. Have the newly identified team review and refine the assumptions and conclusions reached in numbers one, two, and three.
5. Brainstorm potential strategies for solving the problem.
6. Identify the most promising potential strategies and consider them in detail.
7. Select the best strategy.
8. Develop a written work plan for the project that, among other things, includes a detailed program to be used by an architect/engineer to prepare design documents.

Define the Problem

Defining the problem would seem to be elementary. It is. What unfortunately happens in many projects, however, is that the project initiator attacks symptoms rather than problems. The possibilities that can flow from this mistake are frightening. Another potentially damaging blow to effective problem definition is poor communication and misunderstandings between the originator of the idea and the person designated for implementation. These problems can be alleviated by allowing sufficient time for thinking through the root causes of the exhibited problem and reducing the conclusions to a clearly written statement.

A bookstore expansion project undertaken a few years ago provides a good example for illustrating how being deceived by symptoms can allow a project to go seriously awry. The symptoms prompting a perceived need for expansion were too little storage space, not enough retail floor area to display all that was desired, cramped aisles, and not enough room to add extra cash registers to handle book rush. A careful analysis of the symptoms and an honest search for the root causes revealed a much less expensive solution to the problem than adding square footage to the store. Every added square foot would not only be expensive to construct, but would require additional, continuing expenses: staff to cover the new sales area, heating, cooling, lighting, and cleaning.

Consultants with extensive experience in bookstore operations were brought in for a few days to review the situation and report their observations and recommendations to university management. Surprisingly, after their visit, the consultants concluded that the basic space envelope of the existing store was adequate to comfortably support not only the current volume of sales, but as much as 33 percent more.

One of several observations that led to their conclusion was that the store's display fixtures were not up to current standards for efficiency. Upgrading the fixtures alone could significantly add to the amount of merchandise that could be displayed. Displaying clothing on hangers, rather than folded on shelves, cut labor costs. By using slat wall fixtures on the exposed walls and columns, more merchandise could be displayed in the same area. More effectively designed shelving for office and school supplies was recommended to lower the shelf profile for better visibility, while allowing space for a greater amount of merchandise. These improvements had the added benefit of reducing the need for costly back of the house storage, since more merchandise was actually on the retail floor, where it could be sold.

The consultants further observed that senior employees had, over time, managed to carve out and convert valuable retail floor space into private offices for themselves. Their recommendation was an obvious one. These spaces should be reconverted to retail floor area. Employees must be accessible to customers, not hidden away in offices. Necessary work space to replace the offices would have an open design on the sales floor or there would be desks provided in the (smaller) storeroom. Exceptions to private office elimination would be for supervisory privacy to discuss personnel matters or to provide the necessary security and distraction-free environment for accounting and bank deposit preparation.

An analysis of buying practices revealed the lack of a disciplined system for inventory levels. Much more merchandise was on hand than was needed to cover reorder lead times. The superfluous merchandise took up valuable space. Another discovery was a practice of allowing vendor sales representatives to place spinner racks around the store, constricting aisles in an already crowded store. Impulse merchandise was allowed to clutter the cashier's countertop in ever-increasing quantities. Newer counter designs were recommended by the consultants to support the cash registers, allowing impulse merchandise to be displayed above or below the register level. This recommendation allowed for more cash registers in the same linear footage of counter space allocated to the old configuration.

An analysis of sales revealed that some merchandise inventory being displayed was turning at an unacceptably low rate. This slow moving merchandise was eliminated in favor of products that were more popular, resulting in increased sales and profits within the same square footage of display space.

When the review was completed and the real problems defined, it became clear to management that a store addition was not an appropriate alternative for further consideration. The more appropriate alternatives were for improvements in operational practices, with construction limited to remodeling and replacing inefficient fixtures.

Define Goals to be Achieved

After the problem is defined and alternatives considered, all too often the solutions sought—goals to be achieved—are left hazy. It is important to quantify what the goals are. In our bookstore example, in what ultimately became a renovation project rather than new construction, one goal was to shorten the customer's wait in the cash register lines during book rush. Good goal, but not yet clear enough. To determine the needed number of registers, a standard must first be set, such as not allowing a customer to wait more than seven minutes in line. Then, through a review of past customer counts at peak times and an analysis of typical transaction times (using new, efficient equipment and properly trained cash register operators), the exact number of cashiering stations was found to meet the goal of no more than seven minutes in line during rush. This exact requirement was then given to the architect for inclusion in the floor plan drawings for renovation.

Identify Planning Participants

When the planning process has sufficiently progressed to the point that it is certain that a construction project is an appropriate solution to the problem and the goals of the project have been at least cursorily determined, it is time to identify a building committee. At this point in the planning process, enough is known to choose people with the requisite knowledge and interest to contribute to the success of the project. Each person identified should be assigned a specific role in the future work of the committee. In a library project, for example, the archivist may be responsible for analyzing volume requirements for the material being presently stored in archives and supplying the committee with projections of future needs. These projections must include sufficient detail to persuade other committee members, with their own priorities for the limited construction budget dollars, that additional archive space should be included in the final plan.

The number of participants should be kept to a manageable size, yet large enough to provide sufficient ideas and information. Five people are usually a minimum, and eight to ten is about right. Groups larger than ten suffer scheduling problems and have difficulty keeping absentees up to speed on what they have missed. The committee chair should be someone experienced in the institution's capital outlay process.

The first priority of the committee is to develop a written planning schedule, identifying milestone events to mark progress. The role each person on the committee is expected to play should be stated by the chair at the first meeting to avoid confusion later.

Check Assumptions

An early order of business should be a session devoted to a critical review of the assumptions and conclusions made before the building committee was formed. For example, a committee member may know about severe environmental problems specific to the proposed building site. Refining assumptions at this early stage is inexpensive. Changes later in the process become quite costly.

Brainstorming Potential Strategies

A task of the building committee should be to spend some meeting time brainstorming potential strategies for accomplishing the goals identified. It is entirely possible that the larger group, with collectively more expertise, can come up with an entirely different and better idea as to how the problem should be solved. They may, for example, decide that the activity to be housed in the proposed building could be more appropriately and less expensively handled by renting a building from someone else.

Another example of an alternative strategy can be found in a project proposed to provide additional housing for students. The university administration had a goal of continuously working to improve the housing services offered students. In pursuit of this goal, lack of adequate housing for a growing student body was identified as a problem. A committee was quickly formed to oversee planning for a new on-campus residence hall. Once the building committee began meeting, however, discussion revealed that a new apartment complex was being planned for construction on the fringe of campus by private developers. When complete, this project would eliminate the current need for additional housing capacity.

The committee decided that there was a better strategy than new construction to improve the housing services offered students. That better strategy would be to use the financial resources that had been earmarked for new dormitory construction to accomplish needed renovation in existing residence halls. As a result, student housing services would be improved, and the university would have the added advantage of having nicely upgraded facilities that would be more effective in keeping currently housed students from electing to move to the new off-campus apartments.

Usually, strategies will have been sufficiently developed and a sound conclusion reached before appointing a building committee. Radical changes in direction such as those described earlier will rarely occur. However, the point is that in a major building project, millions of dollars are going to be spent. It is worth the time for a building committee to double check the strategy and correct any flaws before going to the next step in the process. The next step is to hire an architect.

The Building Program

Once the architect is hired, the building committee has one last major task to accomplish before the selected architect begins work on the design drawings. The task is to define the building program. This effort should be accomplished in partnership with the architect, who will largely guide the process based on questions generated through experience. The committee's participation in this process will be very important because of each committee member's personal expertise and understanding of the project goals gleaned through participating in the earlier planning. A successful building committee will, however, be open-minded and receptive to the suggestions and recommendations of a design professional who is entering the process as a neutral party, unconstrained by institutional habits and notions.

Following completion of the building program, the architect's design work begins. Because of all the planning that has preceded the architect's development of a design solution, the probability is great that the architect will successfully create just the building design the university wants and needs.

Conclusion

Every building project has its own personality. People involved in building projects have different degrees of experience and expectation. The basic elements of effective pre-design planning are problem identification, goal statement, and strategy formulation. Seems simple, but in practice, projects often get into the design phase too quickly, with too little time spent on these basic elements. If adequate time is spent in pre-design planning, the rewards will be great.

4

Fire The Architect! The Conflicting Perspectives of Architects and Facilities Managers

by Michael Haggans

Dissatisfaction with architectural services is a concern to both facilities managers and architectural professionals. At their worst, design professionals are characterized as prima donnas, educational facilities managers as Draconian taskmasters. This chapter is based on the notion that unrealistic expectations are at the heart of this developing gulf. Currently a practicing architect and formerly a university facilities manager, I have been on both sides. My comments will probably upset both, but the objective is to promote understanding.

The university president wants the project done yesterday. The department chairperson is grumbling about the incompetence of your department. The cost of the project has gone sky high. The desired program isn't being provided. The efforts to reduce costs have led to a design that resembles a camel—a horse designed by a committee.

What Should You Do? Fire the Architect!

Well, maybe you can't fire the architects, but you can blame them. And so it goes. Almost as surely as the swallows return to Capistrano, facilities managers complain about architects who miss schedules, overrun budgets, and pursue design awards rather than provide quality service. For groups who work together so often, why is this the case? This situation derives from unreasonable expectations on both sides.

The architect may expect:	The architect may get:
clear direction	ambiguity, conflicting direction
instantaneous decisions	extensive collaboration
tightly defined scope	scope creep
comfortable construction budgets	inadequate budgets
fair treatment	unreasonable contract provisions
profitable fees	opportunity to invest in the project
quality design expectations	limited aspirations
The facilities manager may expect:	**The facilities manager may get:**
exceptional service	nonchalance
adherence to limited budgets	budget busters
meeting schedule milestones	delays
comprehensive services	requests for additional services
complete construction documents	errors and omissions
cost effective design	extravagance

And this is just a start. Any of these differences in expectations can trigger a cascade of additional difficulties, leading to the breakdown of communication and the development of an adversarial relationship. In my experience, the critical issues are: authority, schedules and decisions, construction budgets, errors and omissions, and fees.

Authority

When I am working with the president of a small college, I receive clear direction. My client is the president. When I am working with a large university bureaucracy, I am less sure, because there are so many different voices speaking at the same time. Each voice belongs to someone seeing himself or herself as the client.

Much of the complexity of the typical educational project comes from the multifaceted nature of the client. The user, owner, and funding authority are at least three different entities, and sometimes four or five. The facilities manager can avoid confusing the users and the architect by clarifying project authority and making it stick. With this information, the architect, users, owner, and funding authority can work in a coordinated fashion.

Schedules and Decisions

Academic schedules often mean that occupancy after mid-August is not worth much. This is certainly the case for teaching facilities and residence halls. As higher education more closely emulates business, time is money. At the same time, educational institutions are often bound by processes that require extensive board approvals. The time between the logical conclusion of a task and board approval can be more than two months. Such processes do not recognize the monetary value of time.

Architects and engineers are often criticized for not meeting deadlines; however, the most difficult group to schedule can frequently be the university's staff. With all of the standing meetings and other project work, there can be only a few hours a week that are available for moving the project forward. In the meantime, the clock is running and deadlines are approaching. It would probably be considered poor service to stop work while each issue is resolved. Occasionally, however, stopping would be providing the best service. Even though deadlines are missed, the cost of proceeding with uncertainty is often greater than delaying to resolve critical issues.

Once a decision is made, some facilities managers expect the architect to meet the original schedule. But a house that takes one person a year to build cannot be built by 365 people in one day. Likewise, a 40-hour task cannot be completed in one hour by 40 people, even if the architect had the best 40 people.

Facilities managers should not expect the impossible, yet they must be on the lookout for signs of trouble with the architect's schedule performance. Many architects have a tendency to underestimate time requirements and to over commit. Resulting delays can compromise the project and cause a host of problems for facilities managers.

Architects and facilities managers should work together to develop realistic project schedules. However, even the best schedule is dependent on continuity of project staff. Changes in key positions require time for getting up to speed. The same is true for the facilities manager. Too many changes on both sides often result in poor communication and missed schedules.

Construction Budgets

What is the problem here? Is the architect always over budget? Or does the user's program always expand, or is the project always underfunded? There are three reasons why the experienced observer can answer yes to each of these questions.

1. Architects suffer from a disease: trying to satisfy all the user's requirements while producing design quality.
2. Users are trying to maximize the project scope.
3. Budgets are fixed years prior to construction.

The symptoms of the architect's disease are attempts to satisfy the expanding needs of the user within a fixed budget, or attempts to provide a luxurious solution on an economy budget. The user's interests are to get as much building as possible because they may never get another chance. The budget was set based on the limits of appropriations or other fundraising expectations.

Some architects play into this situation by promising more than they can deliver and not being realistic about construction costs and the budget. Their raison d'étre is to satisfy user expectations and have it look great. But user expectations always exceed the budget. This is particularly true when the value of the budget has been eroded by inflation, changes in codes, and additions to institutional requirements. This shouldn't be a revelation. The same applies to our own homes. Our aspirations always exceed our means. Life would be pretty dull without this problem.

Most contracts require the architect to redesign if the project comes in over the budget. This would not be so bad if everybody wasn't trying to get seven pounds of project in a five-pound budget.

Many factors beyond the architect's and owner's control can cause projects to be over budget. These include changes in market conditions. However, the usual suspects are continuing "scope creep" and overdesign.

Architects seem to be in the pursuit of design awards, or so it seems to some facilities managers. Schedule, budget, and function are sacrificed in an effort to make an architectural statement. In such cases, the wrong firm may have been hired. Unless there is compatibility between the design expectations of the owner and the architect, everyone will be disappointed.

Balancing the realities of the project is the task of the architect, user, and facilities manager. The user must moderate his or her expectations, the architect must respect the limitations of the budget, and the facilities manager must hold the line on both budget and scope.

Errors and Omissions

Many contracts expect the architect to be faultless. The fact is that they are not. At the same time, the facilities manager should expect complete, thorough, and coordinated construction documents without significant errors. Such documents result from hiring experienced professionals with effective quality control procedures. The goal is complete, coordinated documents without errors or omissions. While this is the goal, the experienced facilities manager knows it is reached only on the rarest of occasions. This does not mean that all the rest of the time the architects have performed poorly. It means that perfection is not a realistic expectation in building design and construction. In general, the value of errors and omissions change orders should be less than one percent of construction value.

Fast-tracked projects should have higher thresholds due to the consequence of later decisions on earlier actions. Each project is unique and contains varied conditions. In any case, the facilities manager who demands no change orders and no errors or omissions is relying on hope in lieu of experience.

Fees

Many facilities managers assume that architects are wealthy, and their attitudes about architects' fees come from this misunderstanding. Some architects are indeed very well paid, but for the most part architects are paid about as much as facilities managers in comparable levels of responsibility. Nor are profit margins such that architects can become investors in your projects. That is what is requested when facilities managers ask for services for free.

To make matters worse, architects and facilities managers value time differently. Time is generally undervalued in an institutional setting. For example, a project meeting might take two hours. If the architect has a staff of four at the meeting, it might cost between $300 and $500 per hour, not counting travel time. However, because of the difference in structure, the owner might have more than twice as many people at the meeting. The costs of staffing meetings are frequently overlooked or dismissed.

So why do architects do it? One reason is that they love what they do. Architects create something from nothing. They fill the blank page. A corollary of the architect's disease is the need to create and to be thankful to those who make it possible, however painfully. This is the dilemma of the architect. For each new relationship is a new marriage, a new chance for the right match between ideal and reality.

In the final analysis, the issue of fees is service. The owner needs to be prepared to pay for the level of service they want, and the architect needs to provide that service. When this equation is not in balance, both the owner and the architect may feel they have been abused.

If you still want to fire your architect, here are a few dos and don'ts for working with the new firm:

DO establish an adequate construction budget. Base your budget on recent comparable experience and estimates before the project starts. Require a detailed cost model at the start of the project and estimates as often as the midpoint and end of schematic design, design development, and construction documents.

DO communicate effectively. E-mail, fax machines, detailed meeting notes, and posting of documentation on a project website are essential to effective project communications.

DO develop a complete program. Net square feet, adequate net to gross ratios, adjacency diagrams, narrative description of project goals and expectations, and other salient project characteristics should be included. Without this information, you are crossing the wilderness without a map.

DO have a realistic schedule. If, in order to open the facility on time, it will be necessary for everything to go right, start your contingency planning now, because Murphy lives.

DO hire a firm with a compatible attitude about design. If cost and function are the key elements of the project, hire a firm with a track record for cost control with detailed knowledge of the building type. If you are looking for campus identity and image, a more design-oriented firm may be required. Such a firm will challenge preconceived notions and stretch the envelope. In any activity, clarity of expectation will avoid confusion and conflict.

DO resolve conflicts about resource allocation. Using the architect to resolve resource issues beats up the architect, confuses the users, and destroys communications. This can only be detrimental to the progress of the project.

DO guard against scope creep. Make it clear to all concerned that additions to the project must be matched by deletions of equal value.

DO think ahead—contingency, contingency, contingency. Always work on the options. With each decision eliminated, some options are eliminated and others are created.

DO deliver bad news in a timely fashion. In an environment where messengers are shot, many facilities managers are tempted to use the architect as the fall guy. Bad news will not smell better with age. The sooner and more directly it is dealt with, the better.

DO NOT rely on the clairvoyance of the architect. Architects aren't nearly as smart as you might think. In particular, they do not know your institution as well as you do. As a consequence, the architect will probably guess wrong in figuring out how to deal with the politics of your institution. This is in your job description under "other duties as required or assigned."

DO NOT promise project delivery when you do not control all of the variables. Without control over weather, product deliveries, labor shortages, bureaucratic processes, decision making, and the architect's production schedule, you will be hard pressed to deliver on the promise.

DO NOT let the architect get away with sloppy work. Just because it is a tough business and you beat them down on fee, you shouldn't accept shoddy or incomplete work. Make your quantitative and qualitative expectations known. The architect should work conscientiously to produce documents without errors and omissions.

DO NOT expect perfection. Change orders, errors, and omissions are a part of life. Even the best project will have some. If you expect perfection you are being unrealistic and will always be disappointed. The key is for the design team to strive to produce a coordinated set of documents with no errors and omissions, and the facilities team to minimize the impact on the project when they do occur. In most cases, the cost of errors and omissions should be less than one percent of construction cost.

DO NOT expect architects to respond to increasing scope without additional fees. This is part of being fair. You don't expect those you supervise to work for free. Why should you expect that from an architect or engineer? You can't expect them to lose a little bit on every project and make it up in volume. Fairness in compensation will pay dividends in service and continued project commitment.

Conclusion

Just as there must be a balance between program and budget, there must be a balance between the expectations of the facilities manager and the architect. When this is achieved, fewer facilities managers will feel like firing their architects and fewer architects will be worthy of firing.

5 Why Do University Buildings Cost So Much?

by E. Gene Kershner

Why do university buildings cost so much? Since the beginning, college and university administrators have been asked that question by their faculty clients, by their vice presidents, and by their trustees.

Nobody can ever believe the bottom line when a budget is assembled for a complex university building, especially the trustees. Often trustees are presidents or chairs of the board of large commercial and industrial corporations. Often they have just finished an expansion of their own facilities at half the cost predicted for a new university project, and they do not understand the difference. As inflation pushes the cost of buildings higher and higher, and as sources of funding for university buildings grow scarcer, these concerns widen, and demands for explanations become understandably more frequent. Therefore, it is imperative that university administrators understand: 1) the high cost of constructing university facilities, 2) the elements of that cost, and 3) the differences between university and nonuniversity facilities. Administrators can then not only explain the reasons for the high cost, but can also be effective in reducing those costs wherever possible.

The primary methodology used by most people to judge the validity of a building's cost is to compare it with the cost of other buildings. This can be misleading. Accurate comparisons are difficult and must be done with considerable care.

Units of Measure for Comparison Must be Clear

The confusion normally begins with the units of measure used. As most of us are aware, the unit of measure universally used in comparing building costs is cost per square foot. But which square foot? Architects normally think of cost per gross square foot. Many academic program officers, however, think of net square feet because it's the space assignable to their program that's most important to them. They have no interest in corridors, mechanical rooms, and duct shafts. Often, net square feet can be 55 to 70 percent of the gross square feet needed to house a program. So the difference between net and gross can be a major source of confusion.

Confusion also results when one talks of construction cost and another talks of total project cost. Construction cost for a building is normally identified as the bid cost, including the structure itself, built-in equipment, on-site utilities, and landscape costs. Total project costs include the preceding, but also encompass design fees, in-house management costs, contingencies, financing costs, and, often, movable equipment and furnishing. Total project costs can be as high as 1.5 or more times the construction costs, resulting in a 30 to 50 percent cost difference.

Therefore, to ensure that university administrators are not comparing apples to oranges, it is imperative that they know whether stated costs are basic construction costs, total project costs, or something in between.

Another common confusion results from our inflationary economy. Buildings cost more this year than last year simply because of increasing costs due to inflation. The cost of a building constructed five years ago would be substantially less per square foot than if it were built today. It is necessary, therefore, that construction costs for buildings being compared be brought to the same index in time by using the *Engineering News Record* index or some other appropriate methodology.

Once the units of measure are straightened out, one may begin to feel confident that comparing building costs on a cost-per-square-foot basis can be done with some ease and accuracy. But this is not necessarily so.

Buildings are Unique

Administrators need to know a great deal about the buildings they are comparing in order to do so properly. Buildings are unique. Some are large, others small. The size alone can affect the cost per square foot by a significant amount. Some buildings are complete; others have areas left shelled, to be completed later. Shelled areas may be included in the square foot totals, but they cost a lot less to build than finished lab and office space. The percentage of office space versus lab space or, speaking more generally, simple space versus complex space, can vary greatly from building to building. Some are large one-story, others are multi-story; each could be approximately the same number of square feet, yet the multi-story building would usually be more expensive to build because of the need for such components as stairs, elevators, and heavier structural systems.

So comparing building costs on a cost-per-square-foot basis is a tricky business, and one that must be carefully approached. Still, it's a methodology that is well known, has been used for years, and will continue to be used in the future.

The Culprit is Complexity

There are two fundamental truths obvious to design and construction professionals: 1) a building's cost is directly proportional to the complexity of the building, and 2) university buildings, especially research buildings, are extremely complex.

To make the complexity of institutional buildings and its effect on the cost of construction clear, an analysis at Stanford University compared a number of campus institutional buildings with a like number of noninstitutional buildings, including high-tech electronic firms and commercial buildings. Building costs were converted into a series of understandable, architecturally meaningful components such as structure, exterior walls, roofing systems, mechanical, and electrical.

Structure

The analysis determined that on the average, institutional buildings have a significantly higher gross square foot cost for structure than the average noninstitutional building. These are some of the reasons why:

1. Since institutional buildings are designed for greater land use/density efficiencies, they are generally multi-story structures rather than one-story. This generates greater costs for code compliance (e.g., more stairs, wider corridors, more fireproofing, and fire separation requirements), heavier foundations, and greater seismic and wind-bracing requirements than are necessary in one-story buildings.
2. Institutional buildings often have more extensive basements, which require additional excavation, shoring, and waterproofing costs.
3. Greater spans are required for column-free classrooms and for future flexibility to alter the space for other functional uses.
4. Heavier floor loading—100 pounds per square foot versus 50—are required for program needs (e.g., library stacks, research equipment, future flexibility).

5. The configuration and massing of institutional buildings are normally more complex to accommodate mixed program requirements (as opposed to one-story, single-use noninstitutional buildings). First-floor classrooms require heavy beams overhead to support second-floor functions (e.g., heavy library bookstacks). The need for adjacent labs and offices, rather than grouping like spaces together, requires costly utility runs and more corridor space. The need for many small offices requiring exterior windows results in less-efficient buildings.

Interior Construction

Another significant cost differential is found in the comparison of components for interior construction. These components consist of interior partitions; floor, wall, and ceiling finishes; function equipment; and vertical transportation. The reasons for the cost differences are:

1. The need for harder, more-durable finishes for high-use areas (for maintenance and, to some extent, aesthetics);
2. Institutional-grade, in lieu of commercial-grade, finish hardware (a heavy-use item subject to damage and high maintenance costs);
3. More extensive function equipment, such as laboratory casework, classroom seating, audio-visual equipment, library shelving, bookshelves, and chalkboards; and
4. Elevators—necessary in multi-story buildings for access by persons with disabilities and the movement of people and material—must be of better quality to reduce maintenance.

It might be useful to point out that a commercial or industrial building is often built with more emphasis on a low first cost rather than life-cycle cost because it is expected to serve a short-term function—perhaps five years or less—and the cost of operating and maintaining the building is not of the paramount importance that it usually must be for educational institutions. This difference in life expectancy is one of the primary reasons for the need for increased quality, and therefore increased costs, for educational buildings for which long-term operating costs are important. This concern becomes especially apparent in interior construction.

Mechanical and Electrical Systems

Operational considerations are also important with electrical, plumbing, heating, ventilation, and air conditioning (HVAC) systems—areas where program sophistication can have a substantial impact on costs.

The various mechanical and electrical systems for a building are significantly affected by the program or functional responsibilities of those systems. In structures that must house intense research and teaching programs, complex, sophisticated air, heat, and light systems are required or the program will suffer, often drastically so. Mechanical systems, more than any other single building component, represent the single largest cost variance. The reasons for the cost differential between institutional buildings and noninstitutional buildings are indicated below.

1. Fully enclosed, institutional-grade air-handling units are used, in lieu of roof-top commercial-grade units, for longevity (15 to 20 years of life versus 5 to 10), reliability, and less routine maintenance.

2. HVAC control systems are more sophisticated in allowing zoning and metering for energy conservation and localized environmental control. Institutional-grade control systems are also used in lieu of commercial-grade ones for reliability and less routine maintenance.
3. Critical tolerances for heating, cooling, and humidity are required for unique and sophisticated research programs. Control systems requiring an environment with temperature variations of less than plus or minus one degree are considerably more expensive than systems allowing greater temperature variations.
4. Heavy air-change requirements are necessary to accommodate fume hoods for research or animal holding areas.
5. Special conduits for TV, computers, and audio-visual equipment, and more extensive signal and communication systems, are often required.
6. More wall may be exposed to the weather because of configuration and multi-story aspects of institutional buildings, requiring larger HVAC loads.
7. Larger electrical loads are necessary for research requirements.
8. Full sprinkler systems are required by many educational institutions.

To summarize, specific program requirements necessitated by the complex, sophisticated research and teaching functions to be housed can have a dramatic impact on construction costs. While the shell costs for a building are fairly static, the program costs will vary substantially—as much as five- or six-fold depending on the complexity of the program. University buildings are at the high end of the range because program requirements for institutional buildings are generally more intense than for noninstitutional buildings.

The costs of a building generally has a direct proportional relationship to the complexity of the systems in the building, and administrators must be aware of and understand these systems if they are to understand the costs of the buildings they want built.

Codes and Standards

Two more aspects of building that affect cost are codes and standards. In any analysis of the cost of construction, one must not overlook the substantial impact that the multitude of requirements mandated by government agencies has on the design, and therefore the cost, of buildings.

Codes apply more restrictive requirements to multi-story building. Since most institutional buildings must be multi-story in order to maximize land density, these restrictive requirements almost always are applicable, inevitably adding to their cost.

Examples of such requirements are stairs, fire separations, fire-resistive construction, wider corridors, extensive sprinkler systems, and seismic bracing.

Revisions in existing codes and the adoption of whole new codes have proliferated in recent years. Buildings constructed as recently as seven to ten years ago simply should not be compared to present buildings because governmental regulations have added to the cost over the last decade.

Life-Cycle Cost Considerations

The primary focus of this article so far has been on program costs as they relate to meeting the academic or functional program of a building.

Of lesser impact, but still important, are the program requirements pertaining to the longer life cycle and commensurate maintenance, labor, and utility costs university buildings require.

Operational and maintenance (O&M) costs for a building during a 30-year period can approach one-and-a-half times the initial cost of construction.

As mentioned earlier, many noninstitutional buildings are built with the idea that O&M costs can be written off as a cost of doing business, or that the building will be sold or otherwise disposed of in a five- or ten-year period. In such cases, high potential O&M costs are of less concern than the initial cost of construction.

Most educational institutions, however, have to fund O&M costs from the operating budget, and those funds are difficult to acquire. Therefore, it becomes extremely important to consider the life-cycle during the design of buildings to ensure that the most cost-effective decisions are made.

How Can University Administrators Reduce Costs?

Once an understanding is reached on what makes university buildings cost so much, one can begin to make some suggestions on how those costs might be reduced.

Obviously, if the program is the chief culprit in higher costs, it seems valid to analyze that area first. Looking at density or quantity first, one might consider whether the number of partitions could be reduced? If so, perhaps the number of doors or windows can be reduced. Can the requirements for HVAC be simplified? Can less complex controls be used? In the actual design of the building, are the most economical spans consistent with program requirements being achieved? Are floor loadings overdesigned? Is the configuration, shape, and massing of the building responsive to economic considerations? Indeed, is the amount of space being built (the actual size of the structure) correct? Are offices too big or labs too generous? Is the efficiency ratio (net to gross square feet) as high as possible? All of these questions relate to quantity or density of the various building components. These areas make up 60 to 70 percent of the cost of a building, and decisions regarding them have the greatest impact.

Once decisions regarding quantity have been made, it is necessary to look at the quality of those components. What are the finishes to be used? Bare concrete or quarry tile? Vinyl tile or acid-resistant seamless flooring made especially for research lab floors? Can lesser quality mechanical and electrical components be justified? These questions have an impact on operational and maintenance costs, but can account for only 20 to 30 percent of the cost—clearly less impact than the question of quantity, but still significant.

Quantity and quality are the two areas constantly in conflict with one another whenever the difficult job of cutting the costs of a building is tackled. If a building costs $150 per gross square foot and one can cut a square foot, presumably $150 can be saved. But if that square foot must be included in the building and the quality of that square foot is reduced by, say, 20 percent, only $30 is saved. So clearly, the greatest saving results from reducing the quantity of square feet to be built. Of course, it is painfully evident to all administrators that their academic clients never get enough space and that any space is almost preferable to no space at all. So it is always difficult to get agreements to reduce building size.

The other area that influences the cost of a building is an area one can rarely do much about: time, market, and institutional influences. Bid dates are normally set by the need for the building and when funds are available rather than when the most propitious market conditions exist. The work available to local contractors, the current season, and any unusual conditions such as strikes and shortages can have an effect on cost. One obvious factor is location: it simply costs more to build in some areas of the country than in others. Institutional requirements such as bonding and insurance requirements, and public prevailing wage laws, may drive up costs. Again, these are all influences that university administrators can do little about, but it is necessary that these influences be understood if building comparisons are to be valid.

Conclusions

Educational institution buildings can cost 15 to 30 percent more than most noninstitutional buildings due to more extensive program needs. These program needs are summarized as follows:

- Complex program requirements, both academic and nonacademic (code, fire, safety, access).
- Longer life than industrial/commercial buildings; greater life-cycle concerns.
- Campus density, aesthetics, logistics, location.

If the elements of the building costs are understood by all members of the project team and creative discussions occur throughout the design process, trade-offs can be considered and decisions made to ensure that the most cost-effective use is made of the institution's construction dollar.

6

Timing is Everything: Meeting the Challenge of Aggressive Project Schedules

by Donald Guckert

How typical is it at your campus to have plenty of time to design and build projects? How often are your clients in no hurry to occupy new facilities? Do your clients usually request their projects far enough in advance to meet their critical occupancy goals?

The time required to design and construct a campus project is one of the most underestimated aspects of our work. It is common, particularly on smaller projects and renovations, for campus clients to approach their projects with unrealistic time expectations and a critical completion date driven by the academic calendar. Even when we are able to complete a project on an extremely tight schedule, our reward is often heightened expectations from other clients who want their project completed with an even shorter turnaround time.

As facilities project managers, we must learn how to handle schedule constraints tied to the realities of funding cycles, research grants, academically driven dates, and other issues unique to a college campus. Understanding the dynamics involved with project schedules and taking advantage of time management techniques can help design and construction professionals successfully meet these challenging and often unrealistic schedules.

Prioritizing Project Goals

The three fundamental goals of any campus project are: 1) lowest cost, 2) highest quality, and 3) shortest time. Since these three goals vary in importance with each project, and the goals often conflict with each other, our clients need to prioritize these goals for their own project.

Sure, everyone wants low cost, but do they want it at the expense of quality? Is the completion date more important than the cost? Do we have adequate time allotted to ensure good quality? Early in the planning process, clients should be encouraged to evaluate their priorities. It may be more important, for example, to complete the campus bookstore by fall semester than to have the project cost 15 percent less or have meticulous workmanship. The priority of goals should be determined by the client, not the facilities project manager. Instead, our role is to point out the dynamics between cost, quality, and time.

Compressing a project schedule often diminishes quality and/or increases cost. Pushing the design professional with an aggressive timetable can result in a poor set of design documents due to a lack of time for careful preparation and review. Likewise, pushing the contractor to complete a project at a breakneck pace usually makes quality a casualty. It is unfortunate, but contractors often find cutting corners is their only option when forced to meet a tight schedule.

Like quality, cost can suffer when schedules are tight. In bidding the project, contractors may realize that the only way to meet the schedule is to work premium time. This premium time could involve longer workweeks, double shifts, or spot premium time. Working beyond the normal 40-hour week kicks in overtime pay; double shifts may incur shift differential pay; and both approaches yield productivity losses. Contractors may also pay premiums for expedited material and equipment. When contractors have to adjust their bids for these additional costs, campus clients end up paying for them in the form of higher bids.

A client who requests a project without sufficient time allotted has subordinated the cost and quality goals to time. However, on the positive side, if the project is given a sufficient amount of time for the design and construction phases, both quality and cost can be optimized. It is our responsibility to educate our clients about the substantial benefits of submitting timely project requests.

Convincing clients to submit project requests with sufficient time for design and construction is a critical first step. However, facilities project managers then must meet the challenge of successfully managing the time that clients have provided.

Building the Pyramid: Decisions and Design

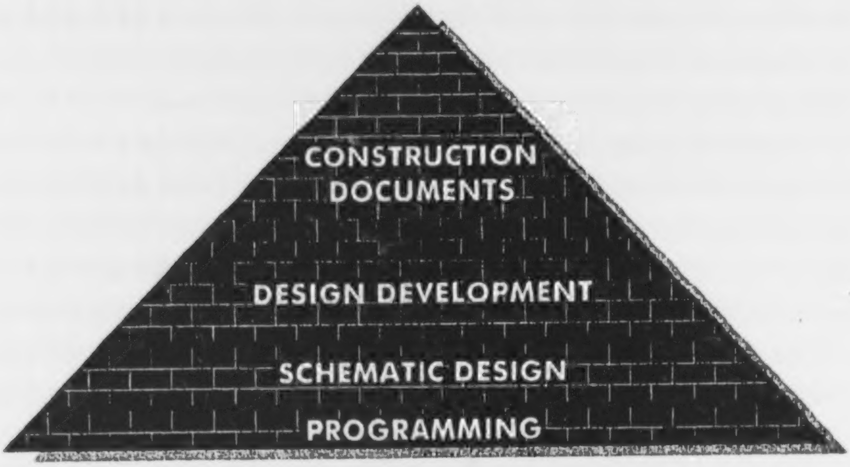
The four basic phases of project design are: 1) programming, 2) schematic design, 3) design development, and 4) construction documents. It is helpful to think of these four phases as building blocks in a pyramid.

Programming: All of the programming decisions stand at the base of the pyramid. In this phase, the client's space and program needs are analyzed and described.

Schematic design: The design team then works with the client to develop a general project layout based on their programming needs. This phase comprises the next few blocks in the pyramid.

Design development: Design development decisions—such as the level of interior finishes and types of mechanical systems—build on the schematic design. Design development is the third tier of the pyramid.

Construction documents: Finally, at the peak of the pyramid, decisions are made on all remaining details necessary to describe the project to the bidding market.



The pyramid analogy helps to portray the discrete phases of the project design. It also illustrates the problems that occur when a decision in an early design phase is reviewed and revised in a later phase. For example, a client may decide late in a project to change rooms 103 and 104 from two offices to a conference room. They see this decision as a simple erasure of a line on a drawing. For the design professional, if the "erasure of the line" is made during the design development or construction document phase, it may mean lighting alterations, changes in the ventilation requirements, relocation of utility chases, elimination of a door, reconfiguration of windows, addition of casework, and so on. Our decisions and design pyramid needs to be dismantled all the way back to the programming level and then rebuilt.

Clients tend to look at the design process as a flexible, open-ended period where everything is still on paper, and changes can be made at any time. However, we must inform clients why changes made late in the design process, such as converting two offices into a conference room, can cause design delays, increase costs, and have a serious impact on their overall schedule.

Scope creep is another common phenomenon of campus projects that can negatively affect the schedule. Scope creep also forces the dismantling of the decision pyramid, but with the added impact of more work to be designed and constructed. The schedule rarely is adjusted to match the increased scope because, as the name implies, the scope "creeps" up on the design team without them realizing the need for a corresponding schedule creep.

Design changes and scope creep are not the only reasons for design delays. The failure to make timely decisions can have an equally devastating impact on the schedule. The culture of an educational institution is one where most decisions are made by consensus. All constituents and stakeholders are invited to be heard and represented if the decision affects them. Unlike corporations, where authority to make decisions is sharply focused on a particular management representative, educational instititutions rarely give decision authority to one individual. Instead, several layers of decision makers may be involved with a campus project. While the "consensus decision" culture may work well with many issues confronting a university, it can be devastating to a project schedule, if not properly managed.

Outside design firms that are unaccustomed to working with institutional clients usually underestimate the time required to complete a campus design project. Consequently, the A/Es (architects/engineers) often find themselves falling behind schedule and rushing through the construction document phase to meet the target advertisement date.

When a project is initiated, project managers should emphasize to campus decision makers, particularly the client, how delayed decisions will hold up the design process. A delayed decision that stops the construction of our imaginary pyramid may be just as devastating as changes that dismantle the pyramid.

Keeping Construction On Track

Proper budgeting of time in the construction phase is critical to meeting a completion date. Usually construction schedules are set by a combination of the A/E's professional judgment and the owner's needs. Project managers should be aware of some inherent problems with construction schedules set in this manner.

It is all too common for a design team to become falsely optimistic about the construction schedule when time is running short due to design phase delays. Human nature drives the design team to grow ever more optimistic that everything will work out once we get to construction. Besides, there is an assumption, made by many, that contractors only work at the pace set by the schedule. If they are given too much time, they will never complete early. If they are given a challenging schedule, they will pace themselves accordingly to avoid the consequences of a delayed completion. While there may be some truth in this belief, applying it to the wrong set of schedule circumstances can lead to failure.

Contractors should be consulted about the budgeted time for construction. Even in a public, openly competitive environment, contractors who regularly bid on an institution's work often are receptive to giving input on how much time should be allowed. Facilities project managers should take advantage of this resource when setting schedules. We may not like what we hear, but the contractor's input can serve as a reality check that might avoid problems later.

Time Management Strategies

What if the project is still short on time, and the residence hall renovation absolutely must be completed by fall semester? This would not be much of an article if the answer was to simply tell the client that more time is needed, and they should wait until spring semester.

There are a number of contractual strategies that may be employed if the construction schedule is tight. The first strategy is to prequalify contractors who will be allowed to bid the project. This is a very effective technique available to most private institutions, but few public institutions.

Institutions should consider prequalifying those contractors who have a solid track record on meeting demanding schedules. Prequalifying contractors who have done previous work for the institution or who have a comfortable working relationship with the campus may not always be the best choice in a tight schedule situation. In the construction industry, as in all industries, there is a large variance of management skills between companies. Project managers should look for contractors who utilize critical path (CPM) scheduling, have a system for tracking shop drawings, select subcontractors and suppliers on the basis of time as well as cost, manage the work of subcontractors, expedite vendor shipments, and take decisive action when delays are detected.

Even public institutions that are restricted from prequalifying contractors can build many of these management attributes into the postqualification requirements of the contract. Requiring the successful bidder to have CPM scheduling capabilities is not unreasonable, even for small projects. Additionally, requiring contractors to submit a schedule with their bids can force them to thoroughly consider the time allowed when putting together those bids.

Often, we must protect the institution from contractor management deficiencies—particularly in public bidding environments. It is often said that the low bidder is the one who made the biggest mistake in putting the bid together. I would add, from a scheduling standpoint, that the low bidder is probably the one who is most unrealistic about how to meet an aggressive schedule.

Owners faced with tight construction schedules will not want to award the contract to the contractor who bid a straight 40-hour workweek. Consequently, owners should consider requiring, through the specifications, that contractors work double shifts during the project or require them to carry a premium time allowance in their budget. Often, a jumpstart on the project is all that is needed to get ahead of the schedule. If all is going well midway through the project, the owner can always relax the double shift requirement or take a credit for the unused premium time allowance. Forcing the bidders to base their bids on a common scheduling approach levels the playing field and lowers the risk of a delayed project completion by the low bidder.

Another possible strategy is to bid the project based on two different schedules. As discussed earlier, when time is constrained, project costs usually rise. Bidding a shorter schedule as an alternative will reveal how much the aggressive schedule is costing. This strategy works simply by bidding a reasonable schedule, such as spring semester completion, as the base bid. The aggressive completion date, such as the earlier fall semester, then is packaged as an alternate. If the client decides to allow more time in order to save money, the decision is made on firm dollars. If the client decides to opt for an earlier completion, it demonstrates to the contractor that the owner is resolved to pay for, and thus enforce, the earlier completion date.

Restrictive Construction Windows

Construction windows, such as Christmas break, spring break, or summer break are targeted for many campus projects. Summer break in particular is a period of high construction activity on college campuses. Summer break is also the time allotted for renovations or repairs to facilities that must remain in operation during the rest of the year.

The key to success with these construction windows is to build sufficient lead time into the schedule. Many renovation projects can be completed within a period of ten to twelve weeks of on-site construction, if all equipment and materials are delivered on time. The design consultant should verify that all specified products critical to the schedule are, in fact, available in the time frame required.

Timely delivery of materials and equipment is a function of shop drawing approval and manufacturing and delivery time, both of which are common causes of construction delays. Consequently, for a project with a summer construction window, the likelihood of meeting an August completion date is increased if the contract is awarded in January or February instead of April or May.

Schedule Incentive Clauses

Even when time management techniques, tools, and resources are available, contractors often lack the motivation to invest in using them. Schedule incentive clauses can provide a monetary incentive for a timely project completion. The most common incentive clauses assess a damage or a penalty on the contractor for a delayed project completion.

Actual damage clause: One type of contractual incentive is an actual damage clause. Under the actual damage clause, the contractor is responsible for reimbursing the owner for all damages actually incurred as a result of a delayed completion. Examples of actual damages include the expense of housing students in temporary facilities, lost bookstore revenue, and increased administrative costs in managing the delayed project. However, actual damages can be difficult to collect because of disputes with the contractor as to whether or not the university really was damaged and to what extent. It is particularly difficult to determine the damages incurred when a classroom or auditorium is not ready for the first day of classes. It also should be noted that most construction firms do not like actual damage clauses because they impose an open-ended risk.

Liquidated damage clause: A liquidated damage clause may be used in lieu of an open-ended actual damage clause. The term "liquidated" merely signifies that the precise amount of daily damages has been established by contractual agreement. An advantage of the liquidated damage clause is the avoidance of future litigation between the owner and contractor over the valuation of damages.

Contractors generally prefer a liquidated damage clause because it reduces the likelihood of disputes with the owner over monetary damages if the project is delayed. However, setting a "daily damages" amount may backfire on the owner if a contractor develops a bid for the project that builds in the daily damages and "plan for" a late completion date. Even after figuring in the damages, the contractor may be able to underbid the competition because it does not have to pay acceleration costs to meet the aggressive deadline.

Across the industry, liquidated damages typically range from a few hundred to several thousand dollars per calendar day. The amount set for damages are legally enforceable, provided they are a reasonable forecast of the damages the owner would be expected to suffer in the event of a late completion. In court cases, where it has been proven that the amount was arbitrary, excessive, or unreasonable, the courts have found that the damages constituted a penalty and thus have ruled the liquidated damage clause unenforceable. Therefore, it is important to validate the prescribed liquidated damages by developing and documenting a sound and fair basis for the determination of damages.

Finally, in several cases, the courts have ruled that the owner need not actually realize damages upon the late completion of a project in order to collect liquidated damages. Just a reasonable anticipation of damages at the time of bidding is necessary to mutually bind the contracting parties. Similarly, if the owner suffers damages for delay in excess of the prescribed damages, the owner is limited to the stipulated damages only.

Bonus/penalty clause: A third type of incentive clause is the bonus/penalty clause. Although the liquidated damage clause and bonus/penalty clause sometimes are used interchangeably, there is a definite legal distinction between the two. Two of the major differences are as follows:

1. Unlike liquidated damages, a bonus/penalty clause does not have to be a reasonable projection of damages (or benefits) realized by the owner for late (or early) completion.
2. If a penalty is stated, then an offsetting bonus needs to be specified as well.

It should be noted that there is a major pitfall in using bonus/penalty clauses. Many contractors have argued successfully that they were denied the opportunity to earn their bonus because of delayed decisions or actions, including change orders, on the part of the owner. Bonus/penalty projects can be documentation nightmares for the owner, where every decision or change order generates a corresponding request for a time extension. Thus, the use of bonus/penalty clauses should be limited to special cases with extremely well-crafted specifications.

Schedule Management

The goal of a schedule incentive clause is not to collect the damages. Instead, the goal is to complete the project on time. As creative and thorough as we may be with contractual clauses, nothing can substitute for competent time management. While schedule compliance is the responsibility of the contractor, as facilities project managers, we need to stay on top of the schedule and use the contractual tools available to us as schedule delays arise.

Early detection and response to delays is the key to meeting a project schedule, and the owner should require the contractor to take immediate action to compensate for delayed activities. This may involve adding additional workers, working overtime, and expediting critical deliveries. The contractors, not unlike the design team, tend to be falsely optimistic as time runs short. Falling into the trap of believing the contractor's assertion that there is enough time in the schedule to compensate for early delays has left many owners with a late project. Since each delay can lead to other delays, it is imperative to make up delays as soon as they occur.

Finally, even the best management strategies and practices cannot protect against unforeseen delays outside the contractor's control, such as abnormal weather and owner-caused delays. Building in a time buffer between the contractors completion date and the required occupancy date can help protect against such delays. Delays, like change orders, are a fact of today's construction efforts and we need to build in time contingencies to cover these risks.

Summary

Project managers can avoid many problems related to schedule compression by following these guidelines:

- Educate the campus client on the benefits of adequate lead time in requesting projects.

- Ask the client to prioritize the project goals of cost, quality, and time.
- Recognize the discrete phases of the design process and manage the decision-making process accordingly.
- Utilize contractual strategies as inducements and incentives for the contractor to meet the project schedule.
- Act immediately when delays occur during design and construction.

Since the time required to design and construct a campus project remains one of the most underestimated aspects of our work, we must continually work to align client expectations with construction realities. But, despite our best efforts, eventually we find ourselves pressured to agree to an unachievable project schedule. The overarching need to complete a facility often clouds rational thinking and behavior. Yet, we must trust our professional experience and judgment and communicate realistically achievable completion dates. While we cannot accomplish the impossible, we have the tools, techniques, and tenacity to meet the challenges of aggressive project schedules.

7 Designing Intelligent Campus Buildings for the Information Age

by Jack Caloz

Three Information Age trends have educational institutions scrambling to take a hard look at the flexibility of their campus infrastructure systems: rapid-fire changes in technology, particularly information technology; increased demand for flexible, technology-focused teaching spaces; and increased systems interconnectivity.

Today's campuses are becoming heavily reliant on infrastructure technology and systems. Students and faculty require access to campus information systems, computerized databases, and research tools from almost anywhere on campus—dormitory, lecture hall, cafeteria, lab bench, the commons, or library—and from remote, off-campus locations as well. Today's wired generation and the future wireless generation will make demands on campus infrastructure, particularly information technology infrastructure, that are unprecedented.

Rapid-Fire Technology Change

To maximize today's significant investment in telecommunications technology and infrastructure support, educational institutions must focus campus-wide, rather than cobble together a building-by-building or school-by-school system. Facilities managers and information services (IS) department heads must also develop an intelligent campus infrastructure that will accommodate today's Information Age systems, as well as new, rapidly emerging technologies. Yet, how can colleges and universities avoid investing millions in infrastructure systems that become obsolete almost as quickly as they are installed?

The crucial factor is to develop a flexible, expandable, and adaptable campus backbone—one maintained and expanded to accommodate growing institutional aspirations, while supporting the legacy systems needs of ongoing operations. Today, technology initiatives are woven throughout the goals of almost every institution, from campus networking plans to distance learning hubs, multi-modal presentations, teleconferencing centers, and computer-assisted experimentation, to name a few. Without a solid, flexible backbone, these initiatives will fail.

We need to pave today's electronic highways for tomorrow's development. The adage, "Build it and they will come," is as true today as it was in the days of the ARPANET. The Internet has shown the previously unimaginable, achievable on an information highway on a global scale. Entire industries have emerged that are dwarfing our traditional ones. We cannot afford to choke the lifeblood of our educational institutions. The backbone infrastructure is the information highway to future opportunities for the students, faculty, and the institution.

Technology Master Planning

Picking the right backbone involves a technology master planning process that focuses on an iterative solution as opposed to an ultimate solution. With the speed of technological change, your plan needs to be reviewed annually in the context of the institution's goals and objectives and the technology that supports those goals and objectives. With goals and objectives defined, the foundation of your technology infrastructure—the backbone—can be accurately assessed.

With microprocessor speed doubling every 18 months since the mid-1970s, a healthy diet of fiber is recommended. Insight into where the backbone is going is based on working with the next generation of IP

(Internet protocol) service providers and Web hosting/co-location firms. While single-mode fiber is still king of the long-haul, high-bandwidth market, there is significant shift in the intermediate range. Distance and bandwidth continue to be the drivers in this market. Gigabit Ethernet is stretching the bandwidth and distance limitations of the standard 62.5-micron fiber. We have seen a material shift in the market from 62.5-micron to 50-micron fiber for those applications where gigabit Ethernet is required or expected.

Copper is still king of the last 90 meters, although specialty requirements are still prevalent and wireless is growing rapidly. While not in the volumes of the past, copper is a backbone dietary must, if not for the building systems and legacy systems, at least enough for a dial tone to call the service provider when the fiber lights go dim.

Wiring is a Key

Making a wrong choice in wiring will have far-reaching implications for future expansion and adaptation. The days of ad-hoc cabling systems are numbered. The increasing demands that high-speed telecommunications systems place on cabling require a highly structured system. The proper design of physical telecommunications infrastructure elements—today's critical "fourth utility"—is a key in assuring optimal network system performance.

In contrast, when various brands of layer-upon-layer of wiring is pulled, connected, disconnected, and reconnected in response to changing technology, it doesn't take long for wiring to become a tangled and confusing mess.

Cabling systems have traditionally been deployed in such a way that the system is not a system at all. The infrastructure becomes a conglomeration of vendor-specific components with little or no interconnectivity. Just as other building utilities must provide high quality service, telecommunications systems must be capable of providing performance, interoperability of systems, and efficiency of administration. Consistent standards-based solutions and careful attention to the associated support systems are essential in assuring many years of information exchange.

Existing and new buildings must give careful consideration to cabling performance, pathways and spaces, power provisions, and the infrastructure's relationship to system performance. Network downtime is often attributable to problems with the cabling media, either at termination points or along the cable length. Add to that the associated administrative time required to track down the problem and costs rapidly rise.

Problems can occur anywhere along the cabling system. Poorly sited or cramped closets, inadequate installation, pathways that do not provide needed support and protection, equipment and termination spaces not properly planned, or power provisions that cannot support the loads incurred—all can lead to system breakdowns.

One reason for a structured cabling system is that technology is rapidly catching up to cable performance. Until recently, performance issues were not as important in many networks because cabling systems were typically designed for transmission speeds beyond the information exchange capabilities of electronic equipment. This is changing rapidly as more aggressive standards emerge and the price of associated high-speed network technology improves. Thus the capabilities of cabling infrastructure will be fully realized.

Standards-Based Systems

Manufacturers have also recognized the advantage of allowing universal interface with recognized, structured cabling systems. Thus a standards-based structured cabling system will provide connectivity for voice, data, video, fire alarm, security, and building management systems.

With the best available cabling media in place, attention must be given to interconnecting hardware. This component is as critical as the cabling when serving high-performance networks. Universal connecting hardware provides a common interface for building systems and allows efficient management of moves, changes, and additions. Connecting hardware is a very hot industry topic, with a focus on assuring that cable segments and connections achieve the same signal performance.

A common misconception is that the infrastructure is temporary and does not warrant the expense required to be "standards compliant." The reality is that the infrastructure often is in place for 15 years or more and congested closet spaces invariably lead to administrative problems due to difficulty in cable termination and identification. Twisted-pair telephone infrastructures, for example, have been in place in many facilities for half a century and are still supported. If technicians do not have adequate working space to terminate, the physical connection may be compromised. The sheer magnitude of cable routed to an undersized closet results in a situation where locating a problem becomes impossible.

Pedagogical Changes

The second trend affects how teaching spaces are designed. Learning environments must be flexible, able to accommodate multi-modal presentations and group learning as well as the traditional pedagogical system of text-based lectures and testing—all within a single space. As a result, barriers that in the past typically separated lecture halls, classrooms, seminar rooms, and student gathering and study areas are quickly coming down. The goal of the Information Age campus design is to provide more intimate surroundings suitable for a variety of teaching methods for increasingly smaller groups of students.

These multiple-use spaces will require a creative and collaborative application of a media mix consisting of copper, fiber, and, yes, wireless. As means, methods, and approaches change to meet the future challenges of today's teachers, the support infrastructure needs to be there to facilitate the process. There should be significant interaction between the users and the designers needs to ensure that the tools of the future are not precluded. Audiovisual support for teachers and state-of-the-art connectivity for students is a must. Today's students need to be prepared for the technological work environment they will enter. They will need to be adept in the use of today's tools and the school has to provide that experience. These challenges are economically achievable,or at least not precluded, when the collaborative efforts of the user and designer are combined to support the aspirations of the institution and the needs of its students and faculty.

Various room shapes and teaching styles notwithstanding, technology is fast becoming the central element in equipping classrooms and student gathering areas. Yet, since a space's design will far exceed the technology's useful life, it is essential that good planning principles be applied to the infrastructure used within the space. For instance, a supporting system we have looked at many times but that has always fallen short of the viability mark is wireless LANs (local area networks).

Until recently, the price/performance functionality was just not there. They were too expensive per point, and performance was less than adequate for anything but the least demanding of applications. It has always been less expensive to cable than to go wireless. While that is still true for most applications, the latest 10+mps product offerings appear robust enough for prime time. The applications in non-traditional spaces such as student gathering areas, historical renovations, and exterior areas, are making wireless LANs a viable solution for today's campus. They are not ready for the engineering or graphical arts labs yet, but will be providing an additional tool for the right media mix formula to facilitate the intelligent campus for the Information Age.

Systems Interconnectivity

The third trend is the increased interconnectivity of systems. This means that, in the future, flexibility is enhanced as building automation systems (temperature control, lighting control, closed-circuit TV, intrusion detection, and access control) and educational automation systems (voice, data, video distribution, Internet access) all migrate to a common platform. This migration, with the right infrastructure system, ultimately will allow the plug-and-play approach to all educational systems in the future. Incorporating wireless personal communications devices, which increasingly will enter the educational universe, will also be a major consideration.

This is an area where we can see some cost relief instead of more capital expense just to keep pace. The improving economics of electronic infrastructure, with its potential exponential increases in productivity, is now a reality. We see it on the campuses as we begin to leverage the migration to a common platform and the true sharing of infrastructure and data among systems.

A well-designed electronic infrastructure will house the educational and operational requirements over the same wires and fibers. They will share data and combine the data from diverse systems to generate information. The information gathered from the campus systems will provide a new, more effective, and less costly educational experience, enriching students, faculty, and the institution simultaneously. New amenities for students will produce additional revenue sources for the institution and expanded opportunities for the faculty. A new paradigm is being created, where the pie increases for all and, at the same time, your campus is Information Age-ready.

8 The Role and Relevance of Project Managers

by Jeff Griffin

Over the past ten years, private sector clients and educational institutions have increasingly employed in-house and/or third party project managers to manage the design and construction of their facilities. As educational institutions seek to gain every last ounce of efficiency out of the project delivery process, this trend appears to be accelerating. With increasing pressures to delivery project management services, coupled with static or declining financial resources, many institutions have turned to third party project managers to compliment their organizational efforts. To fully understand the benefits of third party project management, users must first understand the economic and regulatory trends that have fostered this emergence. With this understanding, many facilities managers will discover a new strategy for delivering projects on tighter schedules with higher quality and lower costs.

Causal Trends

The use of a project manager is a direct response to the need for better coordination of an increasingly complex, fragmented, and specialized design and construction process. To underscore the extreme level to which this trend has developed, think back to how the design and construction process worked three or four hundred years ago. At that time, if the nobility, government, or clergy wanted a significant building built, they hired John the Builder. Together with the owner, John the Builder would pick out a suitable site, design the building, budget the project, find building materials, and hire and oversee the workers and craftsman. John the Builder was the ultimate, full-service, design-build firm. Things were a lot simpler back in those days. However, as recently as 30 years ago, rarely did the project team, even on large complicated projects, expand beyond an architect, and structural and civil engineers.

Today's consultant community is as specialized and fragmented as the myriad of regulations and requirements with which they seek to comply. Civil engineering issues have expanded from traditional site development and utility design issues to include environmental, wetlands, traffic, arborists, etc., each often requiring a specialized consultant familiar with the regulatory and industry specific minutia of their chosen field. Collaborating with the base building architect today may mean an architect who specializes in interiors, a furniture systems designers, an audio/video specialist, or an acoustical, lighting, telecommunications, and security consultant.

On some projects, legal costs alone exceed the cost to design the building. A typical private project might have a zoning/land planning attorney, separate attorneys representing the borrower and lender, as well as attorneys to prepare complicated acquisition, partnership, and operating documents. The list of players is as endless and as varied as the buildings we require.

Changes in the Process

Outside of the growth in the number of players involved, the process itself has become more complicated. It is almost impossible to keep up with the rapid pace of technological advancement in building systems as well as in the teaching and research operating environments. Building codes have become so arcane that there are literally firms that specialize in determining compliance with just the Americans with Disabilities Act. Adding to this confusion are building regulations at the local, regional, state, and federal levels that often conflict with one another and agency reviewers and inspectors that are often inadequately trained to respond to complex questions and are confused about where their agency's jurisdiction ends.

While the process has become more fragmented and complicated, economic pressures have decreased the amount of time available to consultants to solve these complex problems and raised the financial stakes and penalties when the inevitable mistakes are made. Competitive pressure on fees has reduced the dollars available to architects to explore options and to fully document the scope of their improvements.

Time has become such a critical commodity that in the public and private sectors it is never allowed to sit idle. Once funding is obtained or financing secured, the owner wants the building yesterday. Research and teaching environments are changing so rapidly that many institutions have all but given up on long-term planning. The cost for this failure materializes when design and construction schedules are compressed to an unreasonable degree to accommodate these occupancy demands. Incomplete design documents, disputes, and change orders are the result. It is not uncommon on fast track projects for the building's foundations and structure to be underway even before the design has been finalized, permitted, and bid out. A significant coordination error on a fast track project can have six- and seven-figure reverberations through the multiple layers of contracts, permits, and design documents.

Some would ask at this stage, "Aren't the issues raised above supposed to be handled by my architect?" The answer to this question is both yes and no. The architect is rightfully viewed by the community as the leader of the project's design team. However, competitive pressure on design fees and restrictions placed on these professionals by their liability insurance carriers have collectively and methodically narrowed the scope of services and level of project management provided by most architects. Most insurance carriers prohibit their architect clients from entering into design contracts that require the architect to coordinate the work of the various project consultants. In addition, most owners would be unpleasantly surprised if they knew how little protection was truly afforded them by the architect's review of the contractor's monthly construction requisition.

Changes in the Architect's Organization

The personnel and structure of most architectural practices have also significantly changed over the years, with important impacts on the coordination of projects. Typically, a project team is headed by a project architect or principal of the firm, but the majority of the staff hours expended on the project are generated by the lower level architects or designers that produce the construction documents and review the mountains of shop drawings and submittals during the construction phase. These participants are likely to be in their late twenties or early thirties, with less than ten years of professional practice. Although technically competent, they are likely to have more experience with computer-aided drafting and design (CADD) stations than practical field experience earned on a construction job site. Formal management training or business experience is also rare at this level.

Role of the Project Manager

If architects are not being sufficiently paid by the marketplace to assume the broadening responsibility of managing the myriad of consultants described above, if architects' insurance carriers are restricting architects from fully assuming the role of project manager and coordinator, and if architectural firms are increasingly unlikely to have management staff adequately trained to perform the role of the project manager, is the emergence of the owner's project manager such a surprising result?

The role of the project manager can be as narrow as providing advice on a limited project issue and as broad as providing comprehensive services, where the project manager manages the planning, programming, design, and construction process to ensure that the institution's best interests are met at all times. The standard American Institute of Architects Owner/Architect and Owner/Contractor agreements basically establish a three-party relationship between the owner, architect, and contractor.

The owner hires the architect and the architect designs the building. Using these design documents, the owner contracts with a contractor to build the facility based on the documents provided by the architect and per the requirements of the owner/contractor agreement. When the contractor has questions about the design intent of the architect, he or she requests clarification from the architect. Periodically, the architect observes the work in the field to review if the work is constructed according to the plans and specifications. This three-party relationship implies an equality or equilibrium that, in reality, often does not exist.

There are some construction change orders that occur due to unknown or unforeseen conditions. Other than these justifiable claims for additional compensation, most, that are not scope changes initiated by the owner, are due to errors or omissions in the drawings by the designers, or gaps in the owner/contractor agreement that fail to fully define the obligations of the contractor to the owner. Despite a lot of finger pointing between the architect and the contractor when disputes arise, the one truth to this relationship triangle is that the owner almost always pays. After all, the owner is ultimately paying for everything anyway. The owner is paying for the cost to build the facility, and the owner is paying for the design time of the architects and engineers to design the improvements.

Unfortunately, many owners are the least experienced and educated in the details of the design and construction process and, therefore, are at an inherent disadvantage. The project manager levels this playing field by providing experience and technical knowledge solely for the benefit of the owner, free of the conflicts of interest that arise between designers and contractors.

In today's world, it is impossible to expect architects, engineers, and attorneys to draft an error-free set of design documents and contracts. The use of a qualified and experienced project manager, however, can reduce mistakes and effect savings for their owner-client many times the value of the fee charged. The specific responsibilities of the project manager can vary dramatically based on the scope of representation desired by the owner. Typical project management services may include:

- Site alternatives analysis
- Site feasibility and due diligence
- RFP, RFQ selection of consultants
- Managing design consultants
- Bid vs. negotiating contractor strategy
- Soft and hard cost draw requisitions
- Monitoring construction progress and quality
- Project closeout/owner turnover
- Negotiation of consultant agreements
- Budget responsibility
- Negotiating contractor/vendor agreements
- Permitting strategy and acceleration
- Punch list resolution

Project Management Services

There are some very real limitations on the services that the project manager can provide. The project manager is not the architect or the engineer and, therefore, cannot and does not design the building and improvements. Architects and engineers are licensed and regulated professionals who carry liability insurance to protect the owner in the event that they fail to perform their services up to the standards of their respective professions. Does this mean that the project manager is not able to point out areas of the project requiring improvement? Clearly not. The project manager is also not responsible for the means and methods of construction that are the responsibility of the contractor. The project manager, however, can be an important set of eyes on the job site ensuring, to the best of his or her ability and experience, that the contractor's work conforms with the requirements of the project documents.

Although a skilled project manager can make both the contractor and architect better at serving the institution, the responsibilities described above are redundant and overlap the responsibilities of the both the architect and the contractor. The main benefits of employing a staff project manager or retaining a third party project manager are the broader perspective and experience they can provide and their ability to see the bigger picture and coordinate issues across project disciplines.

As with most complicated human endeavors, mistakes and lost opportunities can occur due to poor communication and coordination. The project manager can identify risks and rewards in the early stages of the project that may affect cost and quality in seemingly unrelated areas months later. They can ensure that decisions being made by one consultant are not being done to the greater detriment of the owner on other project issues.

The project manager's experience, broader perspective, and ability to coordinate are critical resources in managing the risk inherent in the development and construction process and protecting the owner. One key area where these resources are applied to the benefit of the owner is in the drafting and negotiation of owner/architect, owner/contractor, and other agreements. These documents establish the responsibilities and obligations of these parties to the owner, and many cost overruns are the direct result of these documents failing to clearly establish and define these relationships. Owners will typically have an attorney review these agreements, but the attorneys have virtually no practical experience in design and construction when compared to the architects and contractors with whom the owner is negotiating.

Attorneys will tend to focus on more purely legal issues while important practical and economic issues will be left untouched, such as who is responsible for delays and costs due to bad weather, what subsurface conditions can and should be covered under the contractor's price, what happens when the design drawings and specifications disagree, etc. To reference an overused analogy, if the project manager is the orchestra leader, these agreements are his or her instrument of control—the music and baton. It is in the negotiation and drafting of these documents that the project manager can provide significant value to the client.

Relevance for Educational Construction Projects

Although the use of third party project management firms is growing in the private sector and even in some areas of public work, are the benefits described above as relevant and as compelling in the educational environment? Changes in the design and consulting professions affect all purchasers of these services equally. The same may not always be said for the public approvals process as many educational systems receive limited review by public agencies or are able to bypass these agencies altogether. However, what these institutions may lack in public approvals they often more than compensate for in multiple layers of internal review and approvals by boards, trustees, and committees.

There are other factors that argue that the educational community would benefit from project management services to an even greater degree than the traditional office, industrial, and retail client. Most educational projects have, by their nature, a very special purpose. Most office buildings can hardly compare in complexity with a new college of engineering building or performing arts hall. The more specialized the project is, the higher the premium that is placed on coordination, because a number of the consultants and contractors may have limited experience with the building type.

Unless the project is a new school on an undeveloped site, most educational projects are either additions to existing and occupied buildings or new facilities built on increasingly congested educational campuses. Coordination with these on-site tenants and their operations adds another layer of complexity to the design and construction process for which neither the architect nor contractor is typically responsible.

Universities with large and steady design and construction workloads may benefit from maintaining a permanent staff of project managers. On the other hand, institutions with varying workloads would benefit from employing third party project managers. Probably the most compelling reason for the use of a qualified third party project manager is for educational clients who are infrequent purchasers of large scale architectural and construction services. Although most school systems and universities have a steady flow of renovation work, construction of large base buildings is comparatively rare. A professional project management firm will generally have numerous base building projects in various stages of design and construction at any one time.

As educational institutions expand their efforts to reduce costs and improve quality, the use of project managers in the design and construction of educational facilities will be increasingly viewed as a sound investment. Given the unique environment in which these institutions operate, and the special-purpose nature of many of the buildings they require, the benefits of project management may well exceed those already being welcomed by the private sector.

9

Partnering and Team Building: Applying New Tools to Project Management

by Boone Hellman

With all of the various demands that are placed on a project manager, the business of project management has become increasingly difficult. A skilled project manager needs to apply a multitude of tools to the project in order to bring it to successful completion. I have discovered two tools, partnering and team building, that are extremely effective in ensuring a successful project.

Partnering and team building are not new concepts. Team building is an essential component of partnering; however, team building can be promoted throughout organizational structures whereas partnering typically involves the pursuit of a specific project. For purposes of this article, partnering and team building will be discussed in the context of construction.

Typically, project managers are well-rounded people. They are often architects, engineers, construction managers, analysts, or accountants, to name a few. What is often not recognized is that project managers also need to possess the power of clairvoyance, the skills of a psychologist, and an understanding of the principles of running a children's day care center. The last statement is partly tongue-in-cheek, but there is a certain amount of truth to the simple fact that project management is not an orderly process. The skilled project manager certainly needs to know how to appropriately apply these skills and attributes at the right place and time in order to juggle the demands of most projects.

Because people and personalities are involved, project management becomes much more than the basic task of organizing materials into a process that will deliver a product within a set amount of time for a given cost. "On time and on budget" is the primary goal of a project manager in any construction project.

What many project managers don't know how to do, or at least not very well, is to manage people as well as time and money. Managing projects well can be easy and straight forward compared to managing people well. This is where partnering and team building come into play. Many in the construction industry are left in the cold when it comes to dealing with how to manage and direct people in diverse and often competing relationships. Some basic understanding of the principal tenets of partnering and team building is all that is required to really give your project management endeavors some additional power.

Partnering and team building allow us to fully recognize the liabilities and assets of all the players involved. If you can manage the people involved, then you've probably solved 90 percent of your problems at the start.

What is Partnering?

Partnering goes back to a way of doing business when a person's word was a bond and people accepted responsibility for their commitments. Mutual trust, honesty, and integrity were the mainstays of everyday contractual relationships. There is no doubt these principles have become seriously eroded in today's litigious society. Partnering fosters these ideals. All parties recognize that every contract includes an implied covenant of good faith.

In the construction industry's accepted way of doing business, all parties seem to be involved in adversarial relationships. Partnering is a process that establishes a relationship of creative cooperation. Partnering recognizes that the goals of the project owner, contractor, and design professional are complementary, not in conflict. Quite simply, partnering enables all participants to understand that it's not "your problem," it's not "my problem," but it is "our problem." Putting on the other person's shoes in order to understand their issues is a key focus in the partnering process. It is essential to have a clear understanding of each other's perceptions and expectations. Communication is obviously the key ingredient in the whole process.

The goals of the parties involved in a project are in fact complementary. The project owner's goals are to safely complete a quality project on time and on budget. The design professionals want to see their creation brought to its full fruition with all of the function and splendor they had envisioned. The contractor wants to maximize his profit and have a happy (and potentially repeat) customer. The partnering process provides the vehicle for identifying and emphasizing the similarities of these common goals through a cooperative effort.

Most often a formal workshop is conducted to introduce and educate all the participants to the partnering process. This workshop can be facilitated by a consultant who makes sure that all participants are involved and are made a part of the project team. The partnering workshop is a forum and opportunity to initiate the key elements of partnering, which are:

- Commitment: Everyone involved must be committed to the overall success of the project, including the highest managerial levels of the owner, contractor, and design professional.
- Equity: Everyone's perspective and interest are considered in the creation of mutual goals for a successful project by utilizing a win-win philosophy.

- Trust: Open communication about motives, risks, and individual goals create a better understanding of those involved. With a mutual understanding of problems, risks, and goals, trust can be developed and nurtured.
- Development of mutual goals and objectives: Jointly developed goals and objectives allow unclouded thinking toward project decisions. This creates a joint investment in the project by all parties.
- Implementation: All parties jointly participate in the implementation of their mutual goals and objectives.
- Continuous evaluation: Like anything else, partnering needs attention and work in order to be successful. Difficulties need to be addressed and dealt with as they occur. Successes need to be analyzed and repeated.
- Timely responsiveness: Mechanisms for quick communication are delineated and incorporated. Issue resolution is handled effectively and expeditiously.

One of the most important products produced during the workshop is the partnering charter or mission statement. Through a series of exercises during the workshop, the participants will create a blueprint of the partnership. The charter should include a general statement of intent as well as shared goals and expectations for the project. Goals should be specific so that it is easy to evaluate the success of the partnership.

Consider the following, an actual mission statement and partnering charter from one of our recent projects:

> We, the partnership, agree to cooperate and are united in our commitment to a profitable, high quality, safe project, within budget and on time. We commit to resolving issues in a noncombative manner and at the level they are raised. We commit to simple,

> professionally researched/prepared/answered and nonbureaucratic correspondence. We commit to meeting or improving the project schedule completion date by good planning, quick responses, good coordination, and avoiding unreasonable expectations. We commit to achieving the quality specified in the contract documents through a commitment to excellence in construction. Alternatives will be carefully reviewed without paradigm paralysis. We commit to monitoring our partnering progress and bringing related parties into the partnering process.

This charter was signed by all the participants and distributed. You can see a great articulation of values and objectives in this charter, which acted as the glue of commonality for all the participants.

Development of an issue resolution process is also an extremely important part of the partnering workshop. Team members collectively agree to a methodology and strategy that will be utilized when disputes arise. Having a clear and concise process to follow for issue resolution allows the team members to feel comfortable that their concerns will be honestly considered. During the partnering workshop, a line of communication is established to be used in the event of unresolved issues. The value of this structure alone is worth the partnering workshop itself.

Partnering is an opportunity for all the stakeholders to meet face to face and discuss their mutual goals and objectives. Often in the past, incriminating letters have traveled in both directions to state what an individual isn't following or doing. When the participants have met in person, there is less tendency to communicate in a negative manner. More often than not, instead of a letter, a simple phone call for clarification can be conducted. Please understand that partnering does not, in any way, abrogate the contract. It simply facilitates communication and mutual understanding between the participants.

What does partnering accomplish? It reduces turf building. There is a reduced exposure to litigation. There is a sharing of the risk by all parties. It allows the energies of all the participants to focus on common issues. Ideas are shared and promulgated. Opportunity for innovation is substantially increased. Mutual goals and objectives are set out at the beginning with the realization that there is a great deal of commonality. Joint satisfaction is a significant byproduct. Most importantly, there is an incredible increase in communication among the people doing the project. Partnering is not a panacea, but it isn't Pandora's box either. It can be an excellent tool to assist in the pursuit of good project management.

What is Team Building?

Team building is a component of partnering, but it can be applied independently of the partnering process. Team building can be utilized to understand your colleagues and how they function. It is the "why we do what we do" aspect of our everyday work lives. If we can understand what makes people tick and realize that to sell ideas to others it helps to understand the way they want to be sold, then our job of people management is simplified immensely. We need to learn how to appeal to each team member's style and pattern of behavior.

Though we are talking about complex psychology, behavioral styles are quite simple. A basic understanding of behavioral styles is all that is needed to be armed with the most sophisticated of team building technologies. There are four basic behavioral styles: the dominator or driver, the influencer or expressive, the steady or amiable, and the critic or analytical. The Myers-Briggs Personality Profile and the work of Larry Wilson and Dr. Paul Mok can be helpful in showing the characteristics and attributes of the different behavioral styles. There are distinct differences in the way people make decisions. If you can identify the decision-making style of your counterpart, then you can approach that person in the same style.

A personal example is noteworthy in terms of how people interact and relate. I retained the services of Nicole Shapiro and Associates to do a management review of my organization. I told her that I often felt frustrated in my relationship with my boss because when I would present an idea or ask a question, he would invariably ask me to prepare a quick written summary of the situation and what issues were on the table. I felt that these issues could be dealt with during the course of our normal meetings and that the written summary was simply busy work. What I discovered was that my boss possessed a critical, analytical behavioral style. These people make decisions slowly, deliberately, and with lots of detailed backup; consequently, the requests for the summarization of issue points. My boss wanted me to give him the information in a manner that he was comfortable with in order to be able to make a decision. I had expected him to be able to deal with the issue collaboratively and immediately. Once I realized this, I approached future issues in an analytic style. I continue to be amazed at the difference this has made in my ability to communicate with my boss.

If you apply the determination of the behavior styles uniformly to all of your communication with your project colleagues, think of the results you will achieve. It takes practice, but with a concerted effort you will begin to feel tangible results. The most difficult aspect is to determine precisely what behavior style a person possesses. However, identification of a few key characteristics will assist you in generally being able to assign a behavior type to most individuals.

In the partnering workshops we conducted, we utilized a behavior style evaluation questionnaire that, upon completion, identifies each individual's general behavioral style. There is not a right or a wrong in the process, nor is one style better than another. It is simply an analysis of the way people are likely to act and behave in their work environments.

Remember that the goal is to be aware of all of the assets and liabilities of the team members. If you can promote the positive aspects and diminish the negative ones, you will be part of a strong project team. A well-functioning team has participants that communicate openly and frankly. They actively listen to one another. An attempt is made to recognize personal styles and to stretch to meet the needs of others. Team members share in the problem-solving process. There is a freedom to confront each other's assumptions without inhibiting further contributions. Conflict is regarded as a healthy and necessary part of the problem solving process.

What do people want on a team?

- To be informed
- To be respected
- To be listened to
- To have their needs met
- To feel safe
- To have a sense of control
- To belong
- To be recognized and rewarded
- To feel competent
- To have a sense of power
- To feel job satisfaction

What can cause a team not to work well?

- People doing it "their way"
- Different values and norms
- Lack of clear direction and focus
- Lack of good leadership
- Hoarding of information
- Unwillingness to change
- Lack of accountability
- Lack of commitment
- Lack of adequate resources

There are obviously many different factors to successful team-building. Knowing as much as possible about your team members is critical and essential if you really want to have an effective team. The analogy of a sports team with its specialists, whether they are quarterbacks, pitchers, goalies, or guards, holds true for successful project teams. Each person has a role and it is the project manager's duty to make sure that the roles and responsibilities are appropriately assigned.

Partnering and team building are awesome tools when applied effectively. There are great gains to be had by the increased communication alone. I encourage you to start a little bit at a time. The customer will be the ultimate beneficiary of these processes because they will result in a higher quality project. These are not management practices that can be applied overnight, but they certainly can be applied over time. I read somewhere that this process was likened to "teaching an elephant to dance; it is going to take a great deal of time and perseverance, but success is possible."

10 Choosing the Best Delivery Method For Your Facility Project

by Blake V. Peck

A college or university embarking on a construction project must make an important decision regarding the method by which the project is designed and constructed—the project delivery method. This decision has become more difficult in recent years as several "alternative delivery methods" have developed to address weaknesses in the traditional design-bid-build scenario. Methods that have gained in popularity include at-risk construction management, fast-track construction, multiple prime contractors, and design-build. Proponents of a particular alternative method promise improvements over the traditional system in terms of cost, project control, and reduction in disputes.

For the facilities owner, the wealth of choices can be both good and bad. The downside is that with the variety of delivery systems—along with the accompanying assurances of the superiority of one method over the others—confusion is inevitable. The good news is that the increased number of alternatives offers the owner or developer more flexibility to choose an appropriate and effective system for a particular project.

Construction management (CM) is a discipline uniquely tailored to the planning, design, and construction process of capital projects. It has proven effective regardless of the chosen contract form or project delivery method. Indeed, CM has been used successfully in all contracting methods and delivery systems by owners who do not continuously maintain the staff expertise or numbers necessary to deal with the complex responsibilities involved in the management of major projects. The following is a brief review of project delivery systems, along with a discussion of some of the important points an owner should consider in choosing a delivery method.

Owner's Requirements

A facilities manager has several areas of concern when embarking on a construction program. The following highlights some of the key considerations in developing a construction program:

Budget

The owner has an obvious need to determine a realistic budget before design to evaluate project feasibility, financing, and alternative designs or site locations. Once the budget is determined, the owner requires project completion at or near the established figure without excessive overruns.

Design

Of foremost importance to the owner is that the desired facility functions as envisioned, and that the design program successfully fulfill the needs of the owner and users. Therefore, an owner requires that its design team be well qualified in the type of facility being designed. In addition, the owner must ensure that the owner's and users' program needs are clearly conveyed to the design team. Since the design of the facility actually must be buildable and properly communicated in order to be useful, the owner requires that the design documents are constructible, complete, and coordinated. The documents should properly incorporate unique features of the site to include subsurface conditions, interface with adjoining properties, access, and other characteristics.

Schedule

The owner has similar needs in the area of scheduling. The date of completion of a new facility can be critical, either in terms of generating revenue from the facility or in terms of providing needed functional space by a particular deadline. Therefore, a realistic assessment of project duration and sequencing needs to be performed early in the planning process. The schedule should then be monitored throughout design and construction.

Risk Assessment

The development of any facility involves many risks. In construction, issues of risk are closely tied to schedule and budget issues. The owner requires an understanding of the risks involved in construction, and should make a conscientious decision regarding allocation of these risks among project participants so that all areas of exposure are properly understood. In considering risk allocation, the owner should strive to assign risks to those parties that exercise control over those aspects. For example, it would typically be problematic to require that the contractor correct problems due to design errors at no extra cost since a contractor generally has little control over the cause or magnitude of such errors.

Owner's Level of Expertise

The owner's familiarity with the building process and level of in-house management capability will have a large influence over the amount of outside assistance required during the process and may guide the owner in determining the appropriate project delivery system.

Review of Project Delivery Methods

Traditional Design-Bid-Build

The traditional design-bid-build system remains the most popular delivery method for construction projects. The owner engages an architect or engineer (A/E) who prepares the design of the complete facility, including construction drawings, specifications, and contract packages.

Once completed, the design package is presented to interested general contractors (GC) who prepare bids for the work and execute contracts with subcontractors to construct various specialty items. In many cases, the contractor submitting the lowest responsible bid is selected to perform the construction. This contractor is then responsible for constructing the facility in accordance with the design. The A/E typically maintains limited oversight of the work and responds to questions about the design on behalf of the owner. The A/E may also assist the owner in administering the construction contract, including determination of project progress, for interim payments made to the contractor.

This contracting system offers the advantage of being widely applicable and well understood, with well-established and clearly defined roles for the parties involved. It is the most common approach for public universities having to comply with state procurement statutes. Furthermore, it offers the owner a significant amount of control over the end product, particularly since the facility's features are fully determined and specified prior to selection of the contractor. However, many construction owners have experienced a variety of frustrations using this system, leading to the development of other methods.

Among the chief disadvantages of the traditional system are:

- The process is time-consuming since all design work must be completed prior to solicitation of the construction contract.
- The A/E may have limited ability to assess scheduling and cost ramifications as the design is developed which can lead to a more costly final product.
- The owner generally faces exposure to contractor claims over design and constructibility issues since the owner accepts liability for design in its contract with the contractor.
- The traditional approach tends to promote more adversarial relationships rather than cooperation or coordination among the contractor, the A/E, and the owner.
- The contractor pursues a least-cost approach to completing the project, requiring increased oversight and quality review by the owner or project manager.
- The absence of a contractor's input into the project design may limit the effectiveness and constructibility of the design. Important design decisions affecting both the types of materials specified and the means of construction may be made without full consideration of a construction perspective.

While the most common approach to bidding a project in building construction is for general contractors to submit a sealed lump-sum bid, many variations in contractor procurement exist in the traditional system.

Other methods include unit-price contracting, which is generally limited to projects that can be easily divided into small work units and quantified prior to construction. This is commonly found in heavy construction projects. At the other end of the spectrum is cost-plus contracting, generally used in circumstances where there is such high risk or variability in the work that preparing a responsible bid is impossible.

When allowed, many owners make some effort to pre-qualify contractors, either through invitation or through an objective set of criteria considering construction experience and financial capability. Doing so helps assure the owner that the contractor is capable of providing a high-quality product. Once the field of bidders is established, an owner bidding a lump-sum project may choose to require sealed bids, wherein the lowest responsible bidder will earn the right to perform the work.

However, many private educational institutions prefer to negotiate bids with pre-selected GCs. This can be an especially powerful technique if the owner considers qualifications, history of claims, and experience in related work, along with price, in its evaluation. What the owner should really be seeking is the best value for the money, not necessarily the lowest initial cost. Through a careful negotiation or contractor evaluation, the owner can maintain the maximum amount of control over the resulting construction portion of the project.

Construction Management at Risk (CM as GC)

This system, adopted and promoted by many large general contracting firms, is similar in many ways to the traditional system, in that the CM acts as a general contractor during construction. That is, the CM holds the risk of subletting the construction work to trade subcontractors and guaranteeing completion of the project for a fixed, negotiated price following completion of the design. However, in this scenario, the CM also provides advisory professional management assistance to the owner prior to construction, offering schedule, budget, and constructibility advice during the project planning phase. Thus, instead of a traditional general contractor, the owner deals with a hybrid construction manager/general contractor (CM/GC).

In addition to providing the owner with the benefit of pre-construction services which may result in advantageous changes to the project, the CM-at-risk scenario offers the opportunity to begin construction prior to completion of the design. The CM/GC can bid and subcontract portions of the work at any time, often while design of unrelated portions is still not complete. In this circumstance, the CM/GC and owner negotiate a guaranteed maximum price (GMP) based on a partially completed design, which includes the CM/GC's estimate of the cost for the remaining design features. Furthermore, CM-at-risk may allow performance specifications or reduced specifications to be used, since the CM/GC's input can lead to early agreement on preferred materials, equipment types, and other project features.

The primary disadvantages cited in the CM-at-risk system involve the contractual relationship among A/E, CM/GC, and owner once construction begins. Once construction is underway, the CM/GC converts from a professional advisory role of the construction manager to the contractual role of the general contractor. At that time, tensions over construction quality, the completeness of the design, and impacts to schedule and budget can arise. Interests and stakeholding can become similar to the traditional design-bid-build system, and adversarial relationships may result. While the fixed GMP is supposed to address the remaining unfinished aspects of the design, this can in fact increase disputes over assumptions of what remaining design features could have been anticipated at the time of the negotiated bid.

One mitigating approach to this problem is for the CM/GC to share with the owner its subcontractor bids, to ensure openness in the process. The CM/GC may further assume risk by taking some responsibility for design errors discovered during construction, if it was involved in the review of the design prior to establishing the GMP. In addition, arrangements can be made regarding risk-sharing and profit sharing if there are overruns or underruns in the GMP.

An owner permitted to use the construction management at-risk approach can realize many benefits. Chief among them are the opportunity to incorporate a contractor's perspective and input to planning and design decisions and the ability to "fast-track" early components of construction prior to full completion of design. However, since a commitment is made to a contractor earlier in the process, a premium is placed on the proper selection of the CM/GC to provide the best value to the owner.

Multiple-Prime Contracting

Another alternative procurement system is multiple prime contracting, in which the owner holds separate contracts with contractors of various disciplines, such as general construction, structural, mechanical, and electrical. In this system, the owner, or a CM manages the overall schedule and budget during the entire construction phase.

This system, which many public universities are required to use, gained favor in part as another method of "fast-tracking" construction. Work in each construction discipline is bid separately, allowing the flexibility of awarding construction contracts on the first portions of the project as soon as the respective aspect of design is completed. This fast-track approach appears to be a highly desirable feature of this method of procurement in cases where time is a critical element.

Furthermore, the system allows the owner to have more control over the project schedule, since the owner sets the schedule for bidding individual portions of the work. For example, if an initial phase of construction (such as foundation construction) is delayed, the owner may reduce liability for delays by postponing the bidding of follow-on work. Another advantage of this system is that the owner can realize savings by directly procuring major material items, such as structural steel or major mechanical equipment, avoiding contractor mark-ups.

However, the very nature of this system causes its primary disadvantages. First, the final cost of the project is not known until the final prime contract is procured. In addition, there have been numerous cases where this method did not work well due to the absence of overall authority and coordination once construction is underway. The problems primarily arise from lack of coordination and contractor delay issues. While the general construction prime contractor is often given contractual responsibility to coordinate the work among trades, including schedule, this contractor lacks the contractual authority to dictate the schedule of another contractor.

For example, during the construction of a university laboratory/classroom facility, delays arose due to coordination issues involving installation of laboratory equipment. The general contractor sought damages from the owner for delays by the mechanical contractor, while the mechanical contractor blamed the general contractor for its delays. This type of dispute is far from unique in this form of contracting, even in cases where the owner has used an independent CM or project manager to coordinate schedule issues.

Design-Build

The design-build (D-B) project delivery system has grown in popularity, and is seen by some in the industry as the perfect solution for addressing the limitations of other methods. For an owner, the primary benefit is the simplicity of having one party responsible for the development of the project. While the other systems often give rise to disputes among various project participants—with the owner acting as referee (or party ultimately to blame)—in D-B many of these disputes become internal D-B team issues which do not affect the owner.

Under this system, the owner contracts with a D-B team, which is often a joint venture of a general contractor and an A/E. Since GCs are comfortable in the role of risking corporate capital in performing projects, they usually are the lead members of this sort of team. One variation of the typical D-B team structure, known as fee-paid developer, involves the owner engaging a developer, which then selects its own A/E and contractor partners. However formulated, the D-B team performs the complete design of the facility, usually based on a preliminary scope or design presented by the owner.

At some point early in the process, the D-B team will usually negotiate a fixed price to complete the design and construction of the facility. Once underway, the D-B team is then responsible for construction of the project, and for all coordination between design and construction.

Since the construction team is working together from the outset, D-B offers the opportunity to save time and money. However, the advantages of the system are offset by a significant loss of control and involvement by the campus clients and stakeholders. Accordingly, it is difficult for the owner to verify that it is receiving the best value for its money, without a great deal of confidence in the D-B team.

The primary caution for an owner considering D-B is the level of involvement that is required for a successful project. First, the owner needs to recognize the effort and thoroughness that must be behind its initial scope/preliminary design that forms the basis of its contract with the design-builder. Often, the owner will require additional consultants to help it develop its scope or preliminary design, in the role of a traditional A/E firm.

Owners with highly specialized program needs or desires may not find it advantageous to turn over responsibility to an outside team, without ensuring adequate levels of oversight and communication. For example, a government owner constructed a high-technology research facility involving highly specialized equipment using D-B. During project development, the D-B team made several key design and equipment selection decisions without full involvement of the owner, resulting in an unsatisfactory facility that required costly changes.

With this lesson in mind, it appears that D-B is best suited to conventional projects for which project requirements can be clearly defined and for which expertise is widely available. For example, a classroom/office facility or dormitory complex might be projects ideally suited for D-B. In projects of this type, the owner is not assuming undue risk in conceding control over the project and may benefit from the advantages of D-B.

Another primary consideration for the owner is proper selection of the D-B team. Since the owner selects a team that was formed prior to hiring them, it may be difficult for the owner to maintain the proper balance of design expertise, financial capability, construction experience, and experience in D-B team roles. In particular, the owner should strongly favor D-B teams with a successful track record working together on previous projects in the same D-B roles. More so than in any other delivery system, the success of a D-B project may hinge on the initial selection process.

Agency Construction Management Services

Agency construction management (ACM), or construction management-for-fee, encompasses a range of services provided by a CM on behalf of an owner. It is a common misconception that CM-for-fee represents a distinct project delivery system. In fact, agency construction management consists of a distinct set of services that are applicable to any project delivery system. These services can be used by the owner as necessary to extend or supplement the owner's own expertise, its own staff, and to manage the construction process to help address some of the shortfalls of the project delivery system chosen.

A CM working as an agent to the owner primarily provides the benefit of independent, professional services provided on the owner's behalf throughout the project. In contrast to some other project participants, the ACM has no vested financial interest in the project—in either its design or construction—and maintains a responsibility to act on the owner's behalf and to provide impartial advice concerning the construction project. As such, ACM firms should be selected based on qualifications, and not on a cost or low-bid basis. The following sections cover services offered by an ACM.

Pre-Design and Design

As discussed earlier, there are often advantages to obtaining construction expertise during the early planning stages of a project. Some services typically offered by ACM firms during planning stages include the following:

- Selection of a design team: An ACM firm, based on historical experience in the market, can assist the owner in selecting the most qualified A/E team to develop project plans and specifications. Similarly, an ACM firm can also assist the owner in evaluating various potential construction sites.
- Budget and cost estimating: Preliminary budgets, based on historical data for similar projects, will assist the owner in determining the feasibility of initial scope. More refined estimates are developed during the design process to pinpoint the necessary construction budget, and provide a basis of comparison to contractor bids.
- Constructibility review: A review of design plans and specifications will help the owner verify that the design as presented is clear to the contractor, poses no construction conflicts, and is economically feasible to build.
- Value engineering: A multi-disciplined team reviews project features to ensure that the owner's necessary functions are provided in the most cost-effective way, both in terms of initial and life-cycle costs.
- Contract bidding: An ACM firm can assist the owner in pre-selection of contractors and development of the bid package to ensure that the contractor selection process is fair and provides the best value to the owner.

In fact, an ACM is often most cost effective during the planning stages of the project, since the ACM firm can provide the careful planning and organization skills that can help prevent costly problems during construction. Properly executed services such as constructibility reviews and preliminary scheduling can result in significant risk reduction and cost savings many times the initial cost in terms of limiting change orders, delays, and contractor claims. Here the owners can maximize the benefits of CM in a professional advisory role throughout the design and construction process because the CM has no stake in the construction contracting.

Construction Phase

ACM firms provide a variety of services during construction, including the following:

- Construction inspection and surveillance: Virtually all owners desire some type of examination of project performance on a continuous or periodic basis to review progress, ensure compliance with specifications and plans, and to review housekeeping and safety issues.
- Project controls: These services are provided to ensure that the project is efficiently and effectively managed. They include maintenance of project correspondence, conducting progress meetings, handling submittals and requests for information, documentation of progress, review of pay requests, schedule reviews, and schedule updates.
- Change order review: These services include negotiation of change orders with the contractor, coordination with A/E over design changes, determination of responsibility for changed conditions or coordination conflict, and review of price and schedule changes.
- Project closeout: Review of the project to ensure orderly and timely completion, including development of punch lists; monitoring of implementation, training and warranty periods; resolution of outstanding issues; review and analysis of claims or disputed issues.

The most frequently cited criticism of ACM services is that the CM adds a level of bureaucracy to a project, resulting in added cost. While it can be argued that such costs may actually reduce overall project costs, it should be noted that an owner can realize the benefit of the ACM services without necessarily committing to large increases in expense by supplementing its own project management as necessary and selecting an ACM on a service-specific basis.

The owner has the option of tailoring its use of ACM services to its needs in order to provide the best combination of project control and cost. For example, many public universities have a large contingent of inspection personnel but may lack sufficient management experience to enact effective project cost controls. Or an owner may wish to have more construction knowledge built into the design process by engaging an ACM firm to perform a value engineering or constructibility review. An owner may also desire enhanced scheduling expertise in coordinating its various designers and contractors for a multiple-phase effort.

Other owners may be very comfortable with their A/E team, but may need assistance in finding qualified contractors to perform the work. Many owners use an ACM's construction closeout services to resolve intractable problems on projects which degenerate due to disputes with a contractor over schedule and delay issues.

Recommendations and Conclusion

Clearly, there is no one right project delivery method for a given project. All of the methods discussed have been used successfully and have weaknesses which can limit their success. The following considerations should guide the owner in selecting the proper delivery method:

- Type of project: The owner should gauge the level of complexity and uniqueness of the project and maintain an appropriate level of control.
- Size of project: The amount of outside assistance and number of project participants should match the significance of the project. Obviously, the more complex and costly a project, the greater the need for professional management and advice.
- Owner capabilities: The owner should realistically assess its own in-house capabilities in evaluating project procurement methods.
- Time considerations: If the project needs to be constructed in a severely compressed time limit, methods adaptable to fast-track construction should be considered. However, the owner must weigh the need for the compressed time limit against the increased cost and risk of fast tracking.
- Likelihood of changes: If the owner is aware that its requirements may change considerably during the project, this should be evaluated against the potential cost of such changes. For example, a D-B team may present the most fluid method of incorporating changes during construction, but those changes may come at a higher cost than through other methods.

Professional construction management can help owners in constructing the best facilities possible, on-time and on-budget. Construction management services are highly desirable, if not essential, to a successful project, especially for colleges and universities lacking this expertise in-house. These services are adaptable to any project delivery system and are scalable to meet the specific needs of the project. An owner should thoroughly explore available options for construction procurement and consider the benefits of professional management services regardless of the contractual approach used to deliver the project.

11

Commissioning New Construction: Getting It Right the First Time

by Robin Smith

The driving interest of facilities management as it relates to the construction and maintenance of buildings is more nearly to that of the "owner" than that of any other entity on campus.

As owners of our buildings, and as professional facilities managers, we constantly evaluate and assess our positions. We desire to know how we compare with others on any number of issues and how we are progressing toward our goals. This assessment is part of our daily task and represents the cause while the process of continuous improvement itself is the effect.

This intertwined relationship is the essence of the Strategic Assessment Model (SAM), APPA's strongest tool for guiding the professionalism of facilities managers. This relationship goes to the heart of our building commissioning process, a practice wherein we must constantly evaluate the needs of our customers and initiate physical elements that produce a continuous improvement of our structures. We learn from each and every step and add this knowledge to our next effort. Our buildings keep getting better. This ongoing discipline is certainly evidence of continuous improvement of the assemblage of our campus buildings.

As we develop and mature in the commissioning process, we branch out into related areas of improvement as discovered and dictated by our constant reassessment. The latest side benefit is the venture into Leadership in Energy and Enviromental Design (LEED) for new construction and soon for the operation of existing buildings. All LEED efforts have commissioning as a basic requirement.

As facilities managers, we are required to look at and indeed be responsible for long-term costs of all building and infrastructure issues. Everything that we do costs money and our budgets are limited. Usually emergencies or any unplanned or unexpected costs take from our planned resources, and this adds to the growing problem called deferred maintenance—deferred until such time that we can get to it, or until it becomes an emergency itself. This method of operation is stressful and is not a very desirable or comfortable way to operate. Changing this culture is slow and difficult and will probably take years. Unless we cause the buildings to function better, operate more efficiently, produce less surprises, and become easier to maintain, this will not change. Changes such as these are very expensive to accomplish in our existing buildings and we are usually not budgeted for this level of retrofit.

The most practical way for us to make these changes is to start these better practices on our new buildings. If we continually improve these new structures, then gradually our whole campus improves. If we learn to do a better job on our new buildings, then it is only a logical next step to fold this skill back into the treatment of our inventory of existing buildings.

Educational facilities operating budgets typically do not provide for corrective or capital-type renovations that are often necessary in order to improve the energy usage, efficiency, or user comfort in existing buildings. For this reason, improving older buildings' performance is often limited to better operating practices, which seems to be the direction being taken by the LEED program for existing buildings.

Our product (new buildings/old buildings) must become less demanding on our maintenance, utility, and cleaning resources if our position is to improve. Now, this is not rocket science. Why, then, is it so hard? The current basic practice of building and maintaining a typical campus is flawed, we do not do a good enough job of involving all the players—occupants, users, maintainers, and bill payers—into the various decision processes.

There is something that can help in this situation; it is called commissioning. Most people have heard of building commissioning and many have participated in the practice or have at least attended training classes, such as the ones that APPA has sponsored for the past few years. The origin of the commissioning process is in the U.S. Navy and its preparation of warships for service. It is this process that we have adapted to our construction projects. In both these efforts, the magic ingredient is really nothing more than careful repeated testing of nearly everything that affects the final performance of either product. This type of testing is not very glamorous, but it is very effective. This is not to say that the commissioning tests are not carefully developed and written out, because they are.

This quality enhancing process for construction is just beginning to take hold in our field and is moving rather slowly, probably due to the complexity and fragmentation of all entities involved. Commissioning a project assures the construction of a facility that meets the needs of the building occupants and verifies functional performance prior to move-in. This verification of performance goes to the heart of the commissioning process. It is accomplished by writing specific functional performance tests and the controlled, monitored execution of these tests. These project specific tests are the very essence of commissioning, and must be written very specifically for components, systems, and the interaction of one system to another. Building commissioning is a meticulous, detailed process involving a great deal of repetition, much unexciting checking, testing, recording, and re-testing. The primary reason commissioning produces better buildings is that this process physically checks and verifies nearly everything. Nothing is left to luck or chance. This is all really simple and straightforward. Commissioning is a different way of thinking that requires new mixes of people working together

At Emory University, one of the best examples of our entire group working together is demonstrated in our monthly project information exchange (PIE) meetings. The collaboration and teamwork exhibited here is the essence of the commissioning process. PIE meetings are voluntary meetings attended by all parts of the campus community who are interested in or affected by our new construction. These meetings have become, in a little more than a year, the meeting of choice for construction information exchange at our university. Regular attendees include risk management, health services, residential housing, security, parking, and others. The success of these meetings is apparently due to the fact that people are able to receive meaningful information about our university's construction and the process that manages it.

One really good way to start the process of commissioning construction projects is with the use of a document called design intent, or as ASHRAE is starting to call it, Owner's Project Requirements. Have you ever heard of this document? Have you ever seen one? Most have not. At the very beginning of the planning process or the programming stage, this simple, plain-English document is developed. It is constructed with input from the future occupants, the construction specialists, as well as the people who will care for and clean the structure. All operational issues are spelled out, such as HVAC requirements, loading dock needs, and maintenance and custodial storage spaces. These rules become the goal of all the participants in the project. Stated simply, this document lists the owner/occupant's expectations for the building or project.

The design intent document is the basis for the commissioning of the building. Commissioning is a quality assurance process applied to the construction project that verifies the performance of the building before the occupants move in. It is important to involve all members of the construction process team in order for the effort to be successful.

Since commissioning gives the owner what the owner wants, it is necessary for the owner to communicate that. It is not sufficient to hope that the consultants will be able to remember the specifics of our preferences, although they will try to do so. Designers really do prefer to have well-defined goals and not be forced to hit a moving target. It is understandable that we each have different motivations, but herein lies the challenge: we must combine our separate interests into one common thread. It is to our advantage to develop and strengthen this collaborative effort. Commissioning is a formalized process that brings us together in a planning mode to anticipate and avoid the problems we have seen in the past.

The entire construction process has continued to become more complex in the quest for better and more energy efficient buildings. These buildings are more dependent on computer controls and complicated sequences of operation. As ever-increasing budget pressures vie with ever-increasing budget demands, the whole process gets harder to manage. On the other hand, many of the problems discovered in our new buildings are very simple and basic, such as specified components missing or not even being installed, or units upside down or running backwards. There often seems to be a lack of even rudimentary inspections on many projects, and if a project starts to go bad, it certainly seems to continue down that path.

What does commissioning cost? Probably the best reply to this question is, "Less than the cost of not commissioning." Given the inherent discipline this process provides, the savings in operating costs in the first year often pay for the entire cost of commissioning. These savings are continued for each year as long as the building is used. Other benefits are not apparent until sometime later when the normal operations and maintenance of the building start to show reduced labor costs, and that less maintenance is required. Any monies spent on this quality process will benefit the operation of the building. If these funds are not channeled in this direction, as is the normal practice, then costs will be higher, problems will be more difficult to solve, and corrections will be funded out of the operating budget rather than out of project funds as they should be.

The cost of commissioning depends on many factors, such as the size of the project, the scope of work required, your skill and effort in bidding, and how much work you do in-house. Our actual experience on commissioning shows an approximate average cost of one-half of one percent of total construction cost. This is contracted directly with a professional commissioning agent. We do all we can to reduce the cost. The main method we have found to do this is to furnish the commissioning agent with staff who perform the testing and documenting—a primary part of the commissioning process.

The benefits of the maintenance staff involvement are more than just saving money; it gives our mechanics a tremendous amount of experience in the new building, which is something we didn't have before. Training is one of the most important aspects of commissioning, and this is really good training. The benefit of this early involvement is readily apparent. This positive project assistance has done as much as any other single element to improve the morale of our operations staff.

When should you start the commissioning process? The answer is, as early as possible. The commissioning provider needs to assist the other members of the project team to determine the "commissionability" of the proposed construction and the ability to verify performance before occupancy. This all goes back to the design intent document—the expectations of the customer.

We spent over a year writing our standards for construction and are now in the first revision effort. Our commissioning requirements are part of our standards and all are published on our website. These standards were written by a broad cross-section of our department. Almost all members of planning, construction, maintenance, and custodial groups contributed. Closeout documents and training requirements are fully covered in the standards and are outlined by standard CSI format. Ancillary services such as recycling, pest control, waste removal, landscaping, and grounds are fully covered. Specific floor finishes, paints, and other items of importance in the care of the building are spelled out. This allows us to do a much better job in the long-term care of our campus.

How do you start something like this? It is imperative that you gather the political support necessary to see this through. In my case, I have the support and encouragement of Emory's administration who, from the onset, strongly encouraged all those involved to work together in the commissioning effort. This is a long-term issue and requires commitment and follow-through. Remember, standards must be written so that the preferences of the owner can be delivered. As with any application of discipline, there will be those who will resist the effort.

When we examine the particulars of the process of commissioning at our university, the relationships we have created stand out boldly. Everything other than these relationships can be categorized as details, and as such, change from day to day and project to project. These working relationships are the key to our success in the entire construction commissioning effort, and it is the only thing that will guarantee our success or failure. Remember, success is accomplished only with determined, conscious, and collaborative effort.

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